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Jan. 1960

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Functional Analysis of CITY ENGINEERING DEPARTMENT Responsibilities page 91

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THE WORLD'S MIGHTIEST MOTOR GRADER

A Valuable Tool for Modern Highway Construction

GALION'S T-700 Grade-O-Matic Motor Grader is a powerful giant with versatile capabilities and tough "muscles" that do precision work or the roughest and heaviest work with the ease of a trained athlete.

● **The gigantic 14′ x 30″ x 1″ hydraulic shiftable moldboard moves the biggest and heaviest windrow of any grader. Maximum reach outside rear tires is 109″.**

This champion of motor graders—with 220 horsepower balanced to 42,000 lbs. of weight—answers the need for new records for fast work cycles, deep cuts, most blade capacity, maximum push power at the blade, and incomparable handling ease.

The most notable advancement in motor grader operation is in the AUTOMATIC features designed into the Galion T-700—automatic multiplication of torque, automatic application of power, and automatic regulation of working speed.

There is no tiresome clutch operation because there is no foot clutch. A power-shift transmission does the hard work. Engine stalling and lugging are eliminated.

Ruggedness of construction is evidenced in the 6″ square solid steel drawbar, the box-type frame which weighs 160 lbs. per foot, the circle weight of 54 lbs. per foot, and the size of the tapered front wheel spindles which are 3¾″ and 2½″ diameter at the bearings. Unequaled front end stability is provided by the 16.00 x 24, 12-ply tires.

The most recent advancements in engineering and design are employed to give the utmost in dependability and ruggedness—the last word in combination manual with power booster steering; efficiency in the circle reverse; thick, heavy, rugged gear case; and the most secure attachment of drive wheels to stub axles ever devised.

Work records all over the country have proved this super grader has unmatched work capacity—the kind that's needed on the mammoth Federal highway construction program. The usual enthusiastic comment of contractors who are using the T-700 is that it does more than twice as much work as any other grader they have ever used.

For further information write The Galion Iron Works & Mfg. Company, Galion, Ohio, or any of their distributors.

● **The torque converter drive, power-shift transmission, tail-shaft governor, and decelerator utilize with utmost efficiency the 220 hp from the Cummins diesel engine. The tremendous weight and power of the Galion T-700 is especially effective on bank-cutting work.**

"from Chicago"

INTRODUCING

the Hydroshear

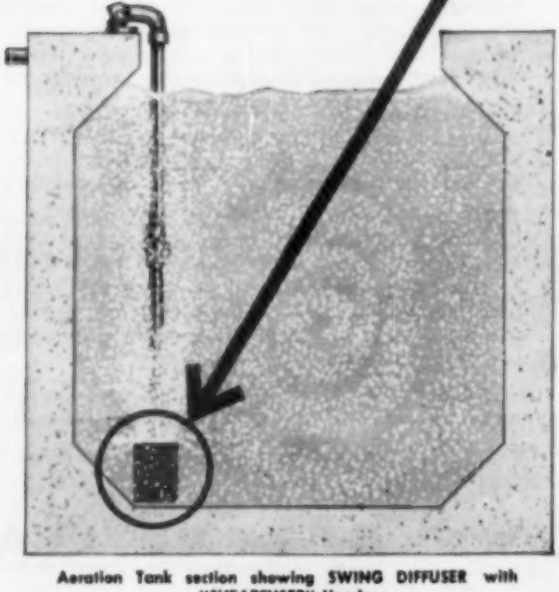
AIR DIFFUSION SYSTEM

Patents Pending

. . . induced counterflowing air-liquid streams shear large air globules from nozzles into fine bubbles . . . causing instantaneous oxygen transfer to liquid, from turbulence, and thousand-fold increased air film surfaces.

Fine bubbles from porous diffusers are recirculated by counterflowing streams to greatly increase total oxygen transfer due to sub-surface tank turbulence.

HYDROSHEAR action in "SHEARFUSER" Nozzle Aerator



Aeration Tank section showing SWING DIFFUSER with "SHEARFUSER" Header

PROVIDES

. . . CLOG-PROOF, highest oxygenation and circulation at lowest air pumpage and power usage.

USES

. . . fine bubble "SHEARFUSER" Air Nozzles, or Porous Diffusers, to obtain required aeration . . . combined with SWING DIFFUSERS for operating flexibility.

Putting Ideas to Work

fmc FOOD MACHINERY AND CHEMICAL CORPORATION

Chicago Pump Company

622F DIVERSEY PARKWAY • CHICAGO 14, ILLINOIS

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Special report to owners of Traxcavators, D6 and D4 Tractors

CAT CATERPILLAR

Parts you can trust
Dependable round-the-clock service

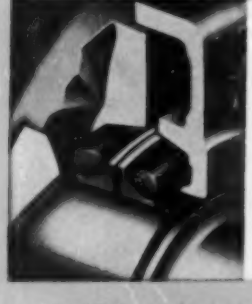
Now available...lifetime lubricated rollers...two-way savings...

ELIMINATE MAINTENANCE GIVE LONGER LIFE

Here's another cost-cutting improvement for Traxcavators and both D6 and D4 Tractors . . . lifetime lubricated rollers. Now you can eliminate on-the-job shutdowns for greasing. And you get longer life from rims, flanges, internal parts. The payoff . . . reduced replacement costs, savings in time.

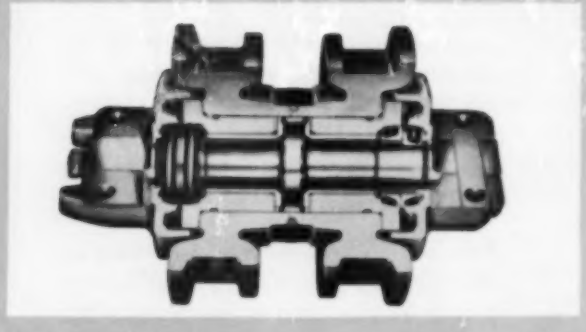
How maintenance is eliminated—the new Cat-built rollers are lubricated when first installed. They are equipped with floating ring seals that keep lubricant in . . . grit out . . . for the life of the rollers. Only when rollers are disassembled for rebuilding will relubrication be necessary. And the original metal rings can be reused.

New floating ring seal . . . only four parts, no springs. The roller seal employs two alloy metal rings and two rubber "O" rings. The metal rings, much harder than the best file steel, have lapped faces, smoother than glass. These faces taper slightly toward the inner edge forming a sealing area at the outer edge. As wear occurs, the sealing area moves gradually inward, maintaining a perfect seal for thousands of hours.



The "O" rings keep constant pressure on the metal rings. Lubricant can't get out. Grit can't get in. There are no springs or diaphragms to weaken, wear or become damaged. The "O" rings are made of special compound to resist oil, heat, cold.

Why do roller parts last longer? Grit is permanently sealed out. Big lubricant reservoirs (with strategically located oil passages) insure ample supply of lubricant to moving parts. Oil instead of grease is used for roller lubricant. Oil dissipates heat faster, circulates more freely than grease. These features assure you of longer shaft and bearing life. Longer bushings with extra-thick flange assures rigid support. Large sleeve bearings provide ample bearing area. Larger diameter, deep-hardened shafts withstand higher shock loads. Beam strength has been increased 63% for D6 shafts; 185% for D4 shafts. Resistance to side thrust is



greatly increased in D4 shafts by a 25% wider center flange and 73% more thrust-bearing area.

Why do rims and flanges last longer? The new two-piece roller shell has greater strength and impact resistance. Special heat-treat process provides extra-hard and deep wear surfaces. Ample steel under tread gives strong support to resist shock loads. Thicker flanges combat peening over. Overlapping center joint maintains rigid shell without separate hub.

Easy installation is achieved by use of snap rings to hold the seals and end collars in place before mounting. End collar bolt holes will line up easily with track roller frame holes during installation.

Millions of hours of proof—the toughest track rollers yet. Cat lifetime lubricated rollers have been subjected to extensive and exhaustive on-the-job tests for over 5 years. Working on all types of job conditions, these time-tested rollers have proved to be unequaled. And machine-owner reports prove that Cat lifetime lubricated rollers can't be beaten for low-cost, minimum maintenance operation.

See your Caterpillar Dealer. He'll give you the full story on this time-saving, money-saving undercarriage component.

Caterpillar Tractor Co., General Offices, Peoria, Illinois, U.S.A.

SERVICE TIP: When rebuild time finally comes, be sure to keep the metal rings matched in original pairs, being careful not to nick or mar the lapped surfaces.

CATERPILLAR

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PUBLIC WORKS

THE MOST USEFUL ENGINEERING MAGAZINE FOR CITIES, COUNTIES AND STATES

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A well-engineered drainage system which is kept in top shape by careful maintenance has prevented flood problems since the Turnpike opened. L. G. Byrd

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BPA

PUBLIC WORKS JOURNAL CORP.
200 So. Broad St., Ridgewood, N. J.

P & K OUTDOOR LIGHTING REPORT

the Modern Trend in LOW LEVEL LIGHTING

P&K CIRCLElux DAVITS AND POSTS

TOP PHOTO: Location: Rath Park, Franklin Square, L. I., N. Y.
Architect: Herbert D. Phillips
Consulting Engineers: Barstow, Mulligan & Vollmer

LOWER PHOTO: Location: Fairleigh Dickinson University, Madison, N. J.
Electrical Consultant: H. L. Sykes

modern lighting at a realistic cost

Here are two contemporary outdoor lighting installations – one an all new municipal swimming pool and recreational area – the other, a prominent New Jersey University. Both chose the P&K all aluminum CIRCLElux lighting package to illuminate and compliment their roadways, walkways, landscape and architecture.

The sweeping lines of the P&K CIRCLElux davit blend with the modern one story architecture of the Rath Park Swimming Pool. Yet, the modern, but stately, design of the P&K CIRCLElux post is in good taste with the traditional architecture of Fairleigh Dickinson University. The CIRCLElux lighting package is the correct low level lighting choice to compliment almost all types of architecture.

The P&K CIRCLElux is available in a wide range of davit styles and mounting heights. The post is available in one basic design but at various mounting heights and with the CIRCLElux you have a choice of three light sources – incandescent, mercury vapor and fluorescent. This combination of luminaires and davits or posts will enable you to specify "packaged" lighting units. This means easier specifying by using matched components which in turn can customize your lighting projects.

Send in your reservation now for the *new* CIRCLElux catalog.

P&K

PFAFF & KENDALL 84 FOUNDRY ST., NEWARK 5, N. J.

BRANCH SALES OFFICES: MIAMI, FLORIDA; BURLINGAME, CALIFORNIA
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The Importance of Tax Exemption for State and Local Bonds

EXEMPTION OF interest on state and local bonds issued for public works improvements has been a highly important factor in permitting financing, at a reasonable rate of interest, of essential improvements. Included in these are highways, water supply and purification, sewerage and sewage treatment, schools and other facilities necessary to commerce, health and community growth. Consideration is now being given by a Congressional Committee to removal of this exemption as a so-called means of broadening the tax base.

This nation is so far behind in the provision of water supplies, the treatment of waste and the construction of highways that anything tending to reduce the market for, or increase the problem of selling, governmental bonds would approach the status of disaster. The relatively small added tax revenue that would accrue—an estimated $500 million to $600 million—would be a very heavy price to pay for the resulting severe dislocation in our already halting progress toward meeting our deficits in essential state, county and municipal needs.

We don't often ask our readers to write strong letters to the Congress but this seems to be a time when the strongest ones possible are needed.

Litter Problems and One Way to Alleviate Them

MOST PUBLIC agencies and many thoughtful citizens are properly concerned over the actions of so-called "litterbugs." In many states laws and ordinances are being passed to penalize anyone caught dumping refuse along roadsides or on vacant lots, or littering rights-of-way. This is only a half solution, if that much. Places should be available where these wastes can be disposed of properly. While many states have provided such service areas along their highways there is still much to be done. Residents in suburban areas often have no means of disposal unless it be a private and often unreliable and uncontrolled scavenger. We believe that every area where household wastes are produced should have access to sanitary landfills or incinerators, installed and operated by whatever governmental unit is appropriate—county, township or other. It will cost money, of course, but it also costs money to clean up those messes originating from the fact that no satisfactory place is available for refuse disposal to the average good citizens.

Package Plants to Help Solve the Sewerage Problem

COUNTING UP the other day, it appears that there are at least ten, and possibly more, manufacturers of package plants for sewage treatment. These are of varying maximum size; some utilize activated sludge and some use trickling filters. The development of these plants represents an answer to the need for small, reliable and economical plants for those areas beyond municipal sewer lines.

State regulatory agencies, no doubt impressed by the fine performance record of the original package plants have, within certain and probably reasonable limitations, accepted them as a solution of small area problems. The exurban type of development is bound to increase and the package sewage treatment plant seems to offer the only way of solving the resulting pollutional problems.

The Water Supply Problem Isn't Solved Yet

A COUPLE of years ago hundreds of cities suffered water supply shortages. Mainly this was a result of one or two dry seasons which reduced basic supplies and also stimulated water use for lawn sprinkling and similar purposes. Looking through perhaps a hundred water reports for 1958 uncovered few complaints of shortages; there was more concern that water sales and water income were lower. This was due to more rainfall, better spaced; and to a lower level of industrial activity.

But this is no time to be complacent and to feel that our water shortages are all cared for. In truth, many cities are on the ragged edge. In a job as essential as providing water, this is no place to be. Reliance should not be placed on getting an above-average rainfall, nor on an industrial slowdown. The water department should be strong enough in resources to meet any reasonable need of the community in dry or in wet seasons.

A Happy and Prosperous New Year to All

IF YOUR DECISION MUST STAND UP FOR 100 YEARS

If your decision today will in some way determine your town's water supply system for the next century, consider the case for cast iron pipe:

- Cast iron pipe is built to *last*—96 American cities will testify to that. They've had cast iron pipe installations in constant use for over a century! And in Versailles, France, they're still using cast iron pipe water mains that were laid in 1664! Solid proof that once cast iron pipe is in the ground, it stays there!
- Cast iron pipe rarely requires repair. Its rugged construction, corrosion-resistant qualities and bottle-tight, rubber-ring joints will withstand the most severe pressures. Once an investment is made in cast iron pipe, it is usually your first and last cost because of the absence of maintenance or repairs.

Don't be fooled by initial pipe costs. You can't save money on "low-cost" pipe if you have to repair and replace it frequently. Insist on the pipe that will actually save you money over a period of years—cast iron pipe!

Cast Iron Pipe Research Association, Thos. F. Wolfe, Managing Director, 3440 Prudential Plaza, Chicago 1, Illinois

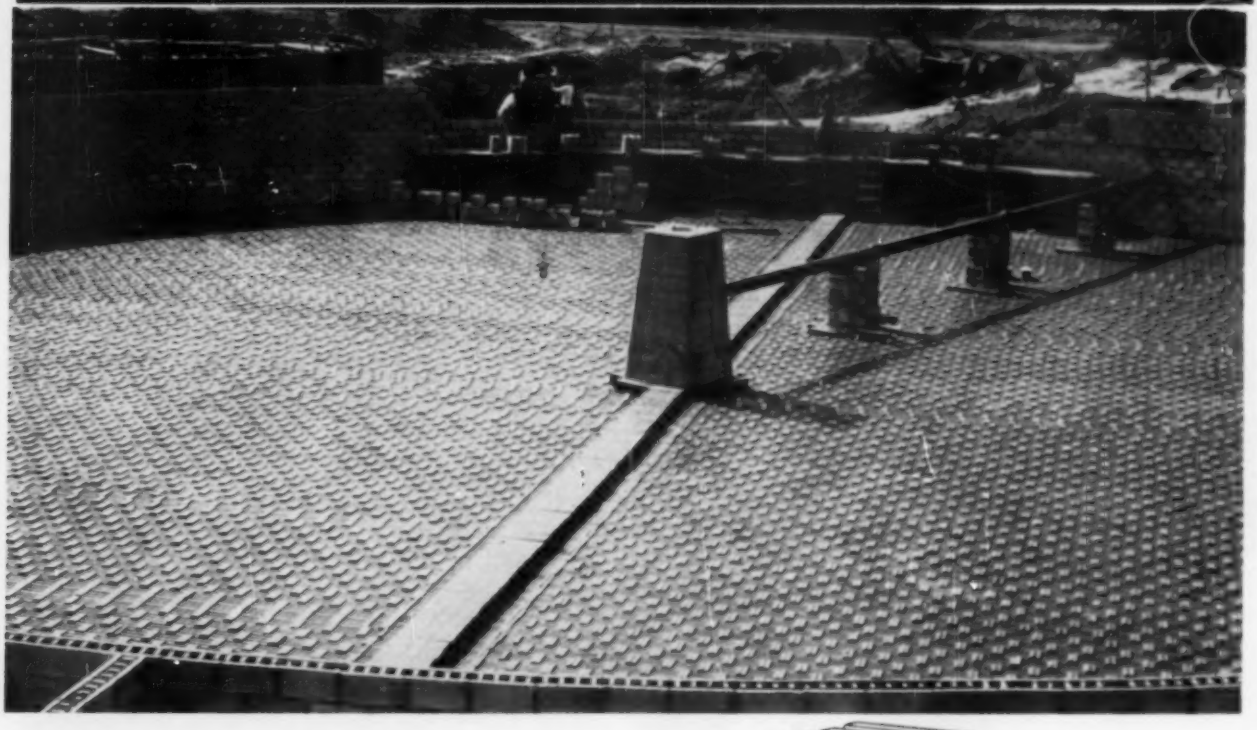
Rely on

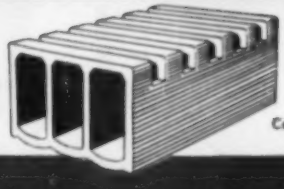
CAST IRON PIPE

THE MARK OF THE 100-YEAR PIPE

Q: Want new industries?

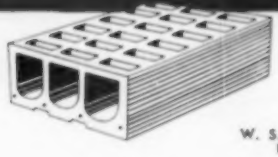
A: Offer clean waters!





TRANSLOT
Connelton Sewer Pipe Co.
Connelton, Ind.

TFFI Trickling



DICKEY
W. S. Dickey Clay Mfg. Co.
Kansas City 6, Mo.

INFORMATION FOR ENGINEERS

Any member of the TFFI listed at the right will be glad to send you a copy of new approved specifications for use in designing trickling filters.

50-YEAR GUARANTEE

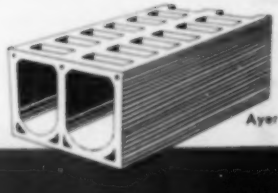
Another exclusive TFFI feature is the manufacturer members' guarantee that their blocks will withstand attacks of every common corrosive and disintegrant force for at least 50 years.

Unpolluted water in ample supply is a powerful competitive factor in bringing new industries to a community. Trickling filters in sewage and wastes treatment plants have become the preferred type for cleaning up our waters. Between 1945 and 1957, 926 trickling filters were built and construction of them has continued since at an unabated pace.

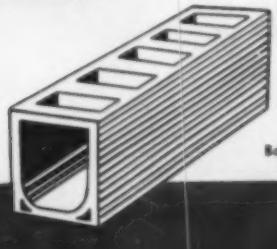
The most vital part of a trickling filter is its underdrain system. When it is of TFFI Specification vitrified clay blocks as pictured at the left, life-time trouble-free service is assured. It is inherent in clay alone to resist successfully the ravages of acids, alkalis and bacteriological action. TFFI blocks are made in modern plants under rigid controls of quality that no substitute materials can even approach.

THE TFFI CONTRIBUTION TO CLEAN WATER

35% or more of America's population is now served by over 2,700 sewage works with trickling filters —most of them guaranteed a long and satisfactory life by use of vitrified clay underdrains.

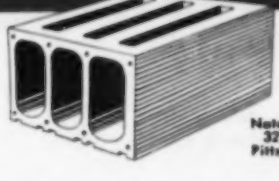


ARMCRE
Ayer-McCarel Clay Co., Inc.
Brazil, Ind.

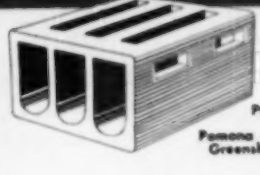


BOSCO
Bowerston Shale Co.
Bowerston, Ohio

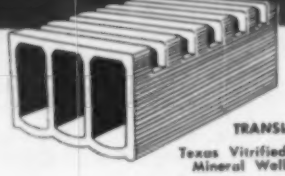
Filter Floor Institute



NATCO
Natco Corporation
327 Fifth Ave.
Pittsburgh 22, Pa.



POMONA
Pomona Terra-Cotta Co.
Greensboro, No. Car.



TRANSLOT
Texas Vitrified Pipe Co.
Mineral Wells, Texas

WHEN CITIES PLAN INDUSTRIAL GROWTH

it pays to specify Vitrified Clay Pipe

SANTA PAULA, CALIFORNIA, already a bustling center of agricultural activity, is building to share in California's phenomenal industrial growth. To accommodate new industry and meet the needs of a growing population, Santa Paula recently completed a bond-financed sewer expansion project, using Vitrified Clay Pipe exclusively. Over 6 miles of Vitrified Clay Pipe were installed.

Like Santa Paula, growing communities everywhere need the permanence and safety that only Clay Pipe can provide. Clay Pipe is the only pipe that never wears out . . . does not rust, rot, corrode, or crumble. And with its new research-developed, factory-made joints, Clay Pipe is faster and easier to install than ever before.

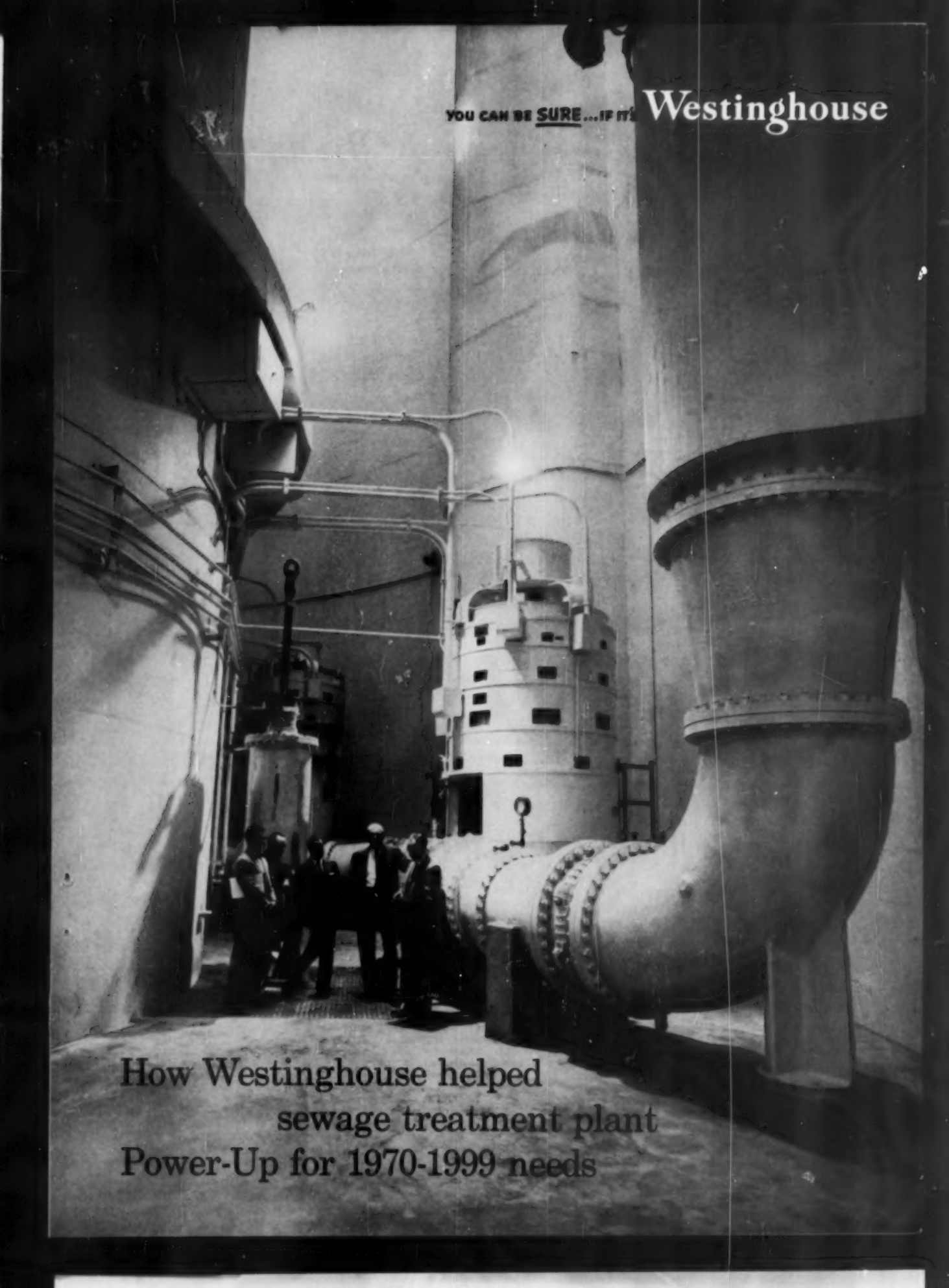
When your community plans new sewerage facilities, be sure to consider the exceptional advantages of Clay Pipe. Its exclusive long-term guarantee is your assurance of permanent, maintenance-free service. Only Clay Pipe has *all* the features you can trust to handle industrial growth.

CITY OFFICIALS: James E. Leary, Mayor; Edwin C. Bixby, Ernest H. Oman, Ralph B. Crawford, Reece B. McCalister, Councilmen.
CONSULTING ENGINEERS: J. M. Montgomery Engineering Co. **CONTRACTOR:** N. P. Van Valkenburgh Co.

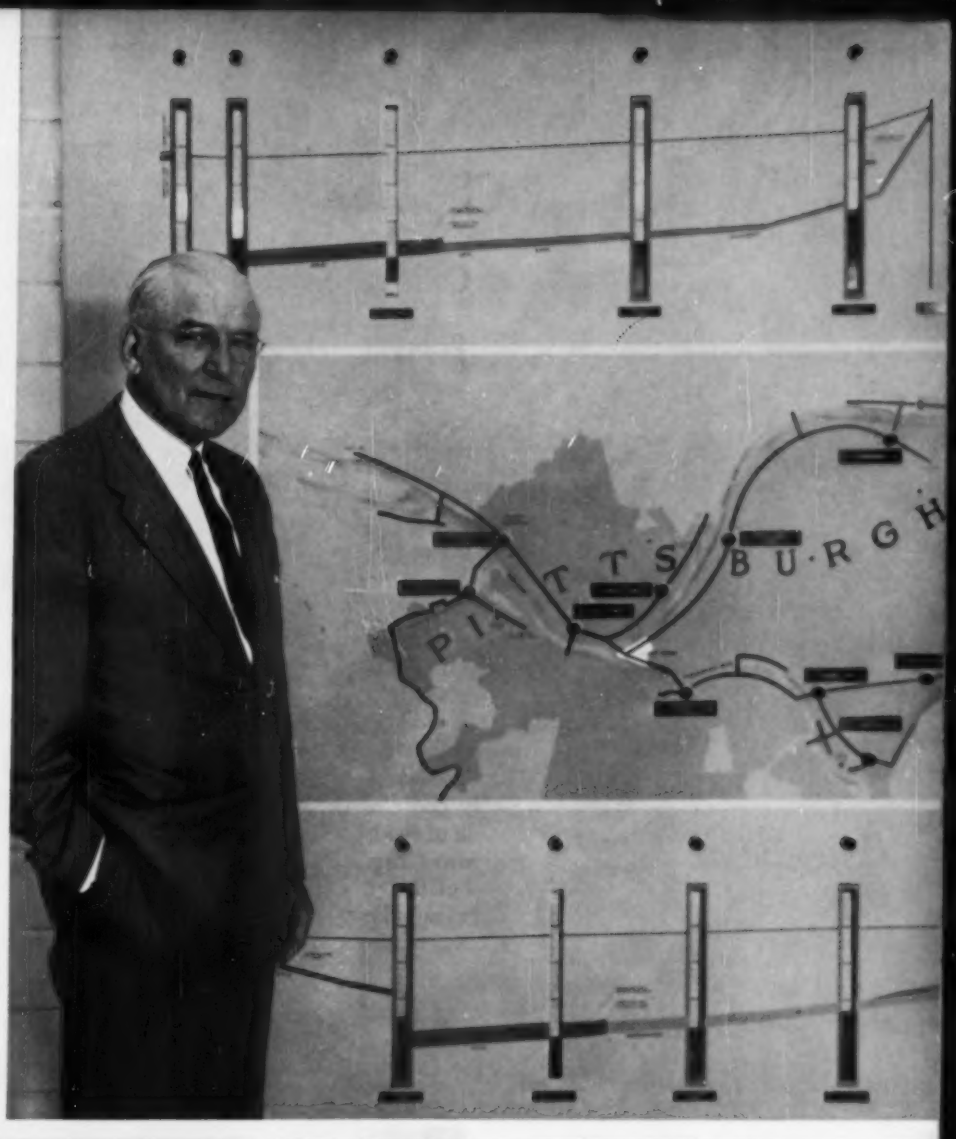
C-159-2A

Vitrified **CLAY PIPE** *Never Wears Out*

NATIONAL CLAY PIPE MANUFACTURERS, INC. 1820 N Street, N. W., Washington 6, D. C.
311 High Long Bldg., 5 E. Long St., Columbus 15, Ohio • 445 Ninth St., San Francisco 3, California • Box 172, Barrington, Illinois • 1481 Peachtree St., N.E., Atlanta 9, Georgia


YOU CAN BE SURE...IF IT'S Westinghouse
How Westinghouse helped
sewage treatment plant
Power-Up for 1970-1999 needs

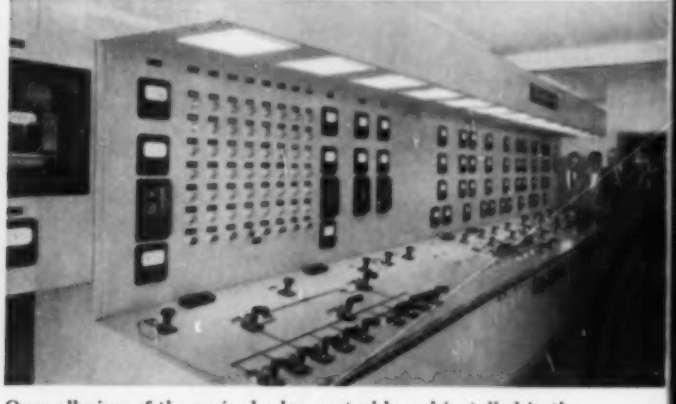
Front Cover: View in dry well of main sewage pump driven by Westinghouse 450/1250-hp 2-speed vertical synchronous motor in foreground. Constant-speed 800-hp motor in background drives its pump through a variable-speed magnetic coupling. Dry well is illuminated with Westinghouse VEK-16 floodlighting. Discussing installation are: A. B. Janaszek, Westinghouse Sales Engineer; M. B. Trimble, Westinghouse Construction Engineer; N. J. Grady, Devlin & Ernst, Electrical Contractors; J. F. Laboon, Executive Director and Chief Engineer, Allegheny County Sanitary Authority; A. A. Thomas, Engineer for Operations, Metcalf & Eddy, Consulting Engineers.



J. F. Laboon, Executive Director and Chief Engineer of Allegheny County Sanitary Authority, shown beside system flow panel of the $100 million trunk sewer and treatment plant project which serves 70 separate communities. The mimic diagram depicts flow conditions throughout a 69-mile network of tunneled interception sewers. The plant and its operation incorporate the process of concentrating undigested sludge for incineration.

J-94134-2

Examining sewage treatment system plans in the director's office are N. J. Grady, M. B. Trimble, A. B. Janaszek, J. F. Laboon and A. A. Thomas.



Over-all view of the main duplex control board installed in the sewage pump station. This board centralizes control of the incoming power feeders, indicates alarm conditions for each main sewage pump and also provides centralized control of pump motor speeds and performance. Shown at far end of control board are A. A. Thomas, A. B. Janaszek, J. F. Laboon and N. J. Grady.

Pittsburgh Sewage Treatment Plant builds for population growth of next 40 years

Planning by the Allegheny County Sanitary Authority went far beyond today's needs to anticipate the requirements of 1970 and beyond, to the year 2000. The new Pittsburgh Sewage Treatment Plant which serves the combined populations of 70 separate communities is now capable of handling the increased demands of 1970 populations. In addition, those structures and conduits which are not readily expandable are designed for the ultimate flow demands of the year 2000.

The Westinghouse electrical distribution system specified was planned with the same anticipation of future needs. Each component was selected to perform as part of the completely coordinated system. The entire system is capable of ready expansion to meet the increased power requirements of the future operating load of the plant.

Westinghouse electrical equipment supplied to Power-Up this 150-mgd sewage treatment project (max. rate, 300 mgd) includes:

- 10,000-kva outdoor substation.
- Main pump control board.
- Three main sewage pump motors (vertical, synchronous), 1250/450 hp, two speed, two frame.
- Two main sewage pump motors (vertical, synchronous), 800 hp, 400 rpm.
- Two major assemblies of high-voltage fused starters and metal-clad switchgear.
- Five indoor dry-type power centers (150 to 3000 kva).
- Seventeen motor control centers as well as panelboards, dry-type transformers and standard controls.
- Westinghouse Life-Line® motors and gear drives which are utilized on pump, conveyor and auxiliary drives.

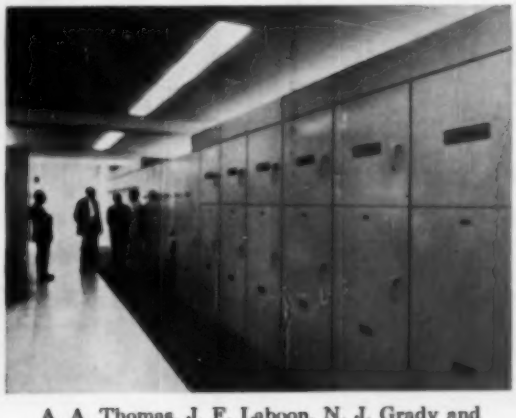
(contd.)

YOU CAN BE SURE...IF IT'S

Westinghouse

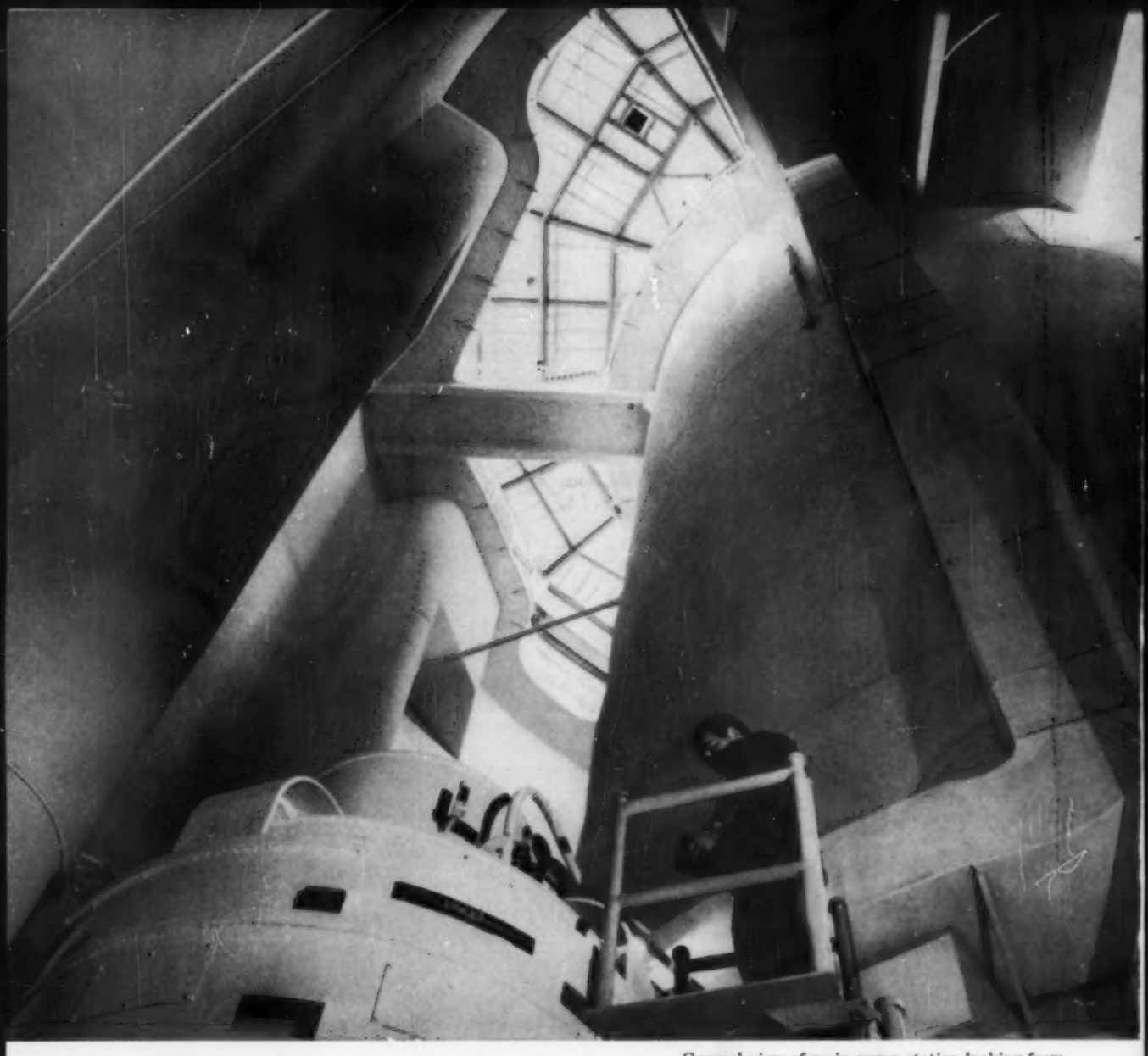
J-94134-3

General view of outdoor substation at Pittsburgh Sewage Treatment Plant. Shown is Westinghouse metal-clad switchgear used for incoming line, bus-tie and distribution service, as well as one of the 5000-kva oil-insulated power transformers at the station. Also shown are Westinghouse disconnect switches, grounding resistors and outdoor substation structure. M. G. Grasha, Plant Electrical Engineer, discusses installation with M. B. Trimble.



A. A. Thomas, J. F. Laboon, N. J. Grady and A. B. Janaszek shown in main control room with line-up of Westinghouse Ampgard® fuse starters for control of the main sewage pumping motors. Metal-clad switchgear in the middle of the assembly provides incoming line protection for each starter group. ®Trade-Mark

M. B. Trimble and M. G. Grasha inspect electrical equipment in administration building basement. At right is rear of motor control center close-coupled to 150-kva dry-type power center transformer; at left is a 75-kva Type DT-3 dry-type transformer feeding a Westinghouse NLAB lighting panelboard.



General view of main pump station looking from the bottom of the dry well up to the main operating floor level 120 feet above.

Sewage plant builds for next 40 years (contd.)

Powering-Up electrically for future growth provides many initial and future savings in public works projects. For information as to what such savings can mean to you, call the Westinghouse electrical construction engineer nearest you, or write: Westinghouse Electric Corporation, Box 868, Pittsburgh 30, Pennsylvania. J-94134-4

OWNER: Allegheny County Sanitary Authority
CONSULTING ENGINEERS: Metcalf & Eddy, Boston, Mass.
CONSULTING ARCHITECTS: Celli-Flynn, McKeesport, Pa.
ELECTRICAL CONTRACTORS: Devlin & Ernst, Pittsburgh, Pa.

Over-all view of Pittsburgh Sewage Treatment Plant. In foreground are the main sedimentation tanks and the effluent channel which discharges into the Ohio River. Circular building at far right is main pump station, behind which is the incinerator building with 300-ft-high stack, a landmark of the installation.

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SPECIFICATIONS

for vitrified clay filter blocks for trickling filters

A.S.T.M. DESIGNATION: C 159-59T

(Engineers using these specifications should check with A.S.T.M. to make sure that they have the latest edition.)

DETACH HERE

SCOPE

1. These specifications cover vitrified clay filter block made from clay or shale or mixtures thereof.

TYPES

2. **(a)** Two types of filter block are covered:

Type I. A one-piece filter block suitable for use in constructing a single-course trickling filter floor, that provides continuous drainage channels or ducts through the lower portion of the block for conveyance of liquids from the filter bed, and drainage and aeration grilles in the upper portion of the block for passage of liquids from, and air into, the filtering media.

One-piece filter block shall include: Type I-S, standard-rate block; and Type I-H, high-rate block.

Type II. A two-unit filter block system suitable for use in constructing a two-course trickling filter floor, that provides drainage and aeration. When placed or assembled, a course of the lower pieces or units forms continuous drainage channels or ducts for conveyance of liquids from the filter bed and for passage of air into the filter bed. An assembly of the upper units forms drainage and aeration grilles for passage of liquids from, and air into, the filtering media.

(b) When in position of use both types of block shall completely cover the floor of the trickling filter bed.

(c) The purchaser should specify whether block shall be Type I-S (Standard-rate), Type I-H (high-rate), or Type II.

COMPRESSIVE STRENGTH

3. **(a)** The average compressive strength of five full-size filter blocks shall not be less than 600 psi, based on gross area of block, with the load applied in the same direction as in service. No individual block shall have a compressive strength of less than 500 psi.

(b) Both component units of the Type II systems, tested individually, shall conform to the compressive strength requirement of Paragraph (a).

ABSORPTION

4. The average water absorption of five filter block, by 1-hr. submersion in boiling water, shall not exceed 6% of the dry weight of the block.

ACID RESISTANCE

5. Filter block shall be acceptable only when the percentage of acid soluble matter for specimens representing such block does not exceed 0.25% by weight.

SHAPE

6. **(a)** Type I filter block shall be square or rectangular in plan, as laid. When placed in parallel rows on the subfloor of the filter bed, cells in a single course of Type I filter block shall form continuous drainage ducts, and the apertures or slots shall provide for drainage and aeration of filter media.

(b) Units for the lower or drainage course and the upper or aeration course of Type II filter block shall be square or rectangular in plan, as laid. When placed in parallel rows on the subfloor of the filter bed, the lower units shall form continuous drainage channels. Upper units, when laid in parallel rows on the lower units, shall provide for drainage and aeration of the filter media.

PERMISSIBLE VARIATIONS IN DIMENSIONS

7. **(a)** Length, width, or height of a Type I filter block shall not vary by more than ¼ in. per ft. over or under the nominal dimension stated by the manufacturer.

(b) Lower drainage channels and upper aeration grilles of Type II block shall not vary by more than ¼ in. per ft. over or under the nominal dimension stated by the manufacturer.

FOLD FLAP OUT ▶

APERTURES

8. **(a)** Apertures in the top of Type I filter block shall be not more than 1½ in. in width, but may vary in length. Aperture area shall be not less than 20% of the top area of the filter block when in position of use.

(b) Apertures in the top, or aeration, course of Type II filter block shall be not more than 1¼ in. in width, but may vary in length. Clear unobstructed aperture area shall be not less than 30% of the top area of the block when in position of use.

SHELL AND WEB THICKNESSES

9. **(a)** Exterior walls (shells) of Type I filter block shall be not less than 9/16 in. in thickness, and interior webs shall be not less than ½ in. in thickness.

(b) Exterior walls (shells) and interior webs and struts of Type II filter block comprising the lower or drainage course shall be not less than 9/16 in. in thickness. Exterior walls (shells) and longitudinal webs of Type II filter block comprising the top or aeration course shall be not less than 1⅛ in. in thickness. Stiffening webs, for stiffening the longitudinal webs, shall not be less than 9/16 in. in thickness.

DRAINAGE CHANNELS

10. **(a)** Effective cross-sectional drainage area shall be defined and measured as the sectional area lying below the lowest level of the aperture slots. Aggregate effective cross-sectional area of drainage channels in a filter block shall be not less than shown in Table I.

Table 1 — Cross-Sectional Drainage Areas

	Minimum Effective Area Sq. in. per ft. of Width
One-piece systems:	
Type I-S, standard-rate	**20**
Type I-H, high-rate	**40**
Two-piece systems:	
Type II	**20**

(b) The shape of the bottom of the drainage channels of any filter block shall be curved or narrowed in width to form a trough in the bottom of each channel to accelerate flow of effluent and to minimize stranding of solids in such channels.

(c) The height of drainage channels in any filter block shall be not less than 2½ in., measured from the lowest level of the aperture slots.

(d) There shall be not less than two parallel drainage channels per ft. of width of a Type I filter block.

WORKMANSHIP and FINISH

11. **(a)** Filter block may be either glazed or unglazed, unless otherwise specified in the purchase order. If glazed filter block are specified, at least 90% of the inner and outer surfaces of the block shall be covered with glaze, excepting the wire-cut ends where it may be entirely absent.

(b) The lower bearing surface of filter block shall not vary from a plane by more than 3/16 in. per ft. of the greatest length or width of the block.

(c) All filter block shall be well burned and substantially free of laminations and fractures. All block shall be free of open cracks exceeding 1½ in. in length, and shall be free of other

cracks exceeding 3 in. in length that do not extend through the webs or shells. All block shall be free of chips larger than 2 x 1 x 3/16 in., and of blisters whose diameters exceed 2 in. and which project more than ⅛ in. above the normal surface.

MARKING

12. All filter block shall bear the name, initials, or trade mark of the manufacturer and shall be marked to show compliance with ASTM specifications C 159. These marks shall be indented on the exterior of the block and shall be legible.

REJECTION

13. If test specimens fail to conform to requirements for compressive strength, absorption or acid resistance, the manufacturer may sort the shipment, and new samples shall be selected by the purchaser from the retained lot and tested at the expense of the manufacturer. In case the second set of test specimens fails to meet requirements, the entire lot shall be rejected.

EXPENSE of TESTS

14. Except as specified in Section 13, expense of inspection and testing shall be borne by the purchaser.

SAMPLING and TESTING

15. **(a)** The purchaser or his authorized representative shall be accorded proper facilities for sampling and inspection of filter block, both at the place of manufacture and at the site of the work. At least ten days from the time of sampling should be allowed for complete tests.

(b) Filter block shall be sampled and tested in accordance with the Methods of Sampling and Testing Structural Clay Tile, (ASTM Designation: C 112) except that resistance of block to the action of acids shall be determined in accordance with the applicable portions of Sections 14 to 18 of the Methods of Testing Clay Pipe (ASTM Designation: C 301).

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GUARANTEE

OF VITRIFIED CLAY UNDERDRAIN FLOOR BLOCKS

The _____

of _____

Warrant and Guarantee to

_____

that all vitrified clay underdrain blocks manufactured by the above said company and furnished for installation in _____

_____ under contract dated _____

between _____ and _____

are proof against impairment of service or failure due to rust, corrosion, decay, chemical decomposition and/or disintegration caused by any action of acids, alkalis, sewage, sewer gases, ground waters or industrial wastes, excepting Hydrofluoric Acid only. Also guaranteed against destruction by rats, rodents or termites.

The undersigned bind themselves for a period of

FIFTY YEARS

after date hereof to furnish to the above named _____ free of cost, vitrified clay underdrain blocks in the same quantity and sizes equal to any of the vitrified clay underdrain blocks manufactured and furnished by above named manufacturer under said contract which may have been damaged, destroyed or impaired in service by reason of any of the above named causes.

It is expressly understood that the conditions of This Guarantee do not provide for Furnishing of Blocks which have been broken or impaired by reason of Improper Handling, Placement or Construction.

The _____ Company

By _____ Title _____

Signed this _____ day of _____ 19____

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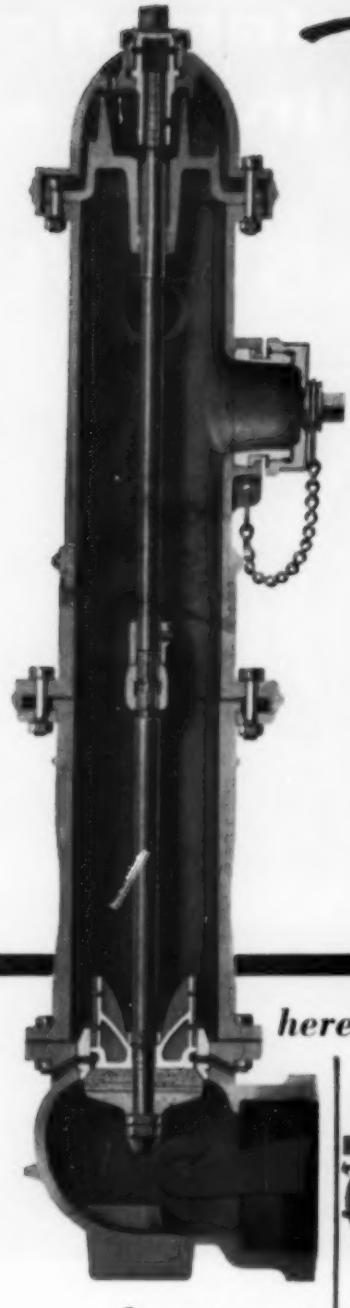
Bonus features

for long life and easy maintenance



Designed for above ground maintenance, Mueller AWWA Improved Hydrants have the bonus features that *count*.

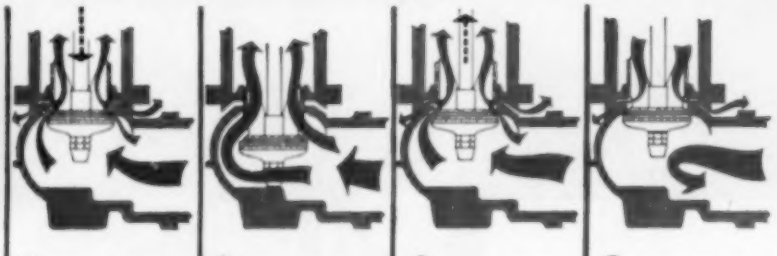
The compression-type main valve and two drain valves positively shut off the flow and drain the barrel after each operation.

Safety Flange design prevents barrel breakage resulting from traffic accidents and permits addition of barrel extensions to raise hydrant in keeping with grade changes.

360° rotation of the upper barrel permits proper facing of the breech-locked nozzles. Dry-top design seals all stem threads and bearing surfaces from water in the barrel during operation. A refillable oil reservoir maintains proper lubrication of the stem threads and bearing surfaces.

Add up these "bonus features" in Mueller AWWA Improved Fire Hydrants and you'll see why so many cities and towns have "Standardized on Mueller".

here's how the MUELLER *main valve works:*



1 Main valve fully closed. Barrel dry.

2 Hydrant opening. During first few turns of operating nut, full water pressure flushes drain ports.

3 Hydrant fully opened. Drain ports closed by sealing surfaces on main valve guides.

4 Hydrant closing. Drain ports again force-flushed by full water pressure during last few turns of operating nut.

5 Hydrant fully closed. Water draining from barrel through open ports.

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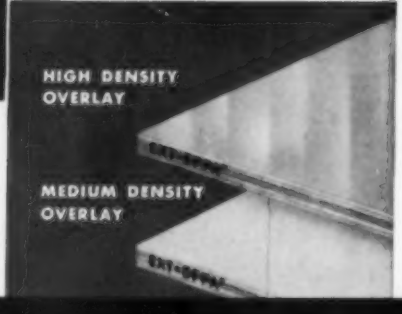
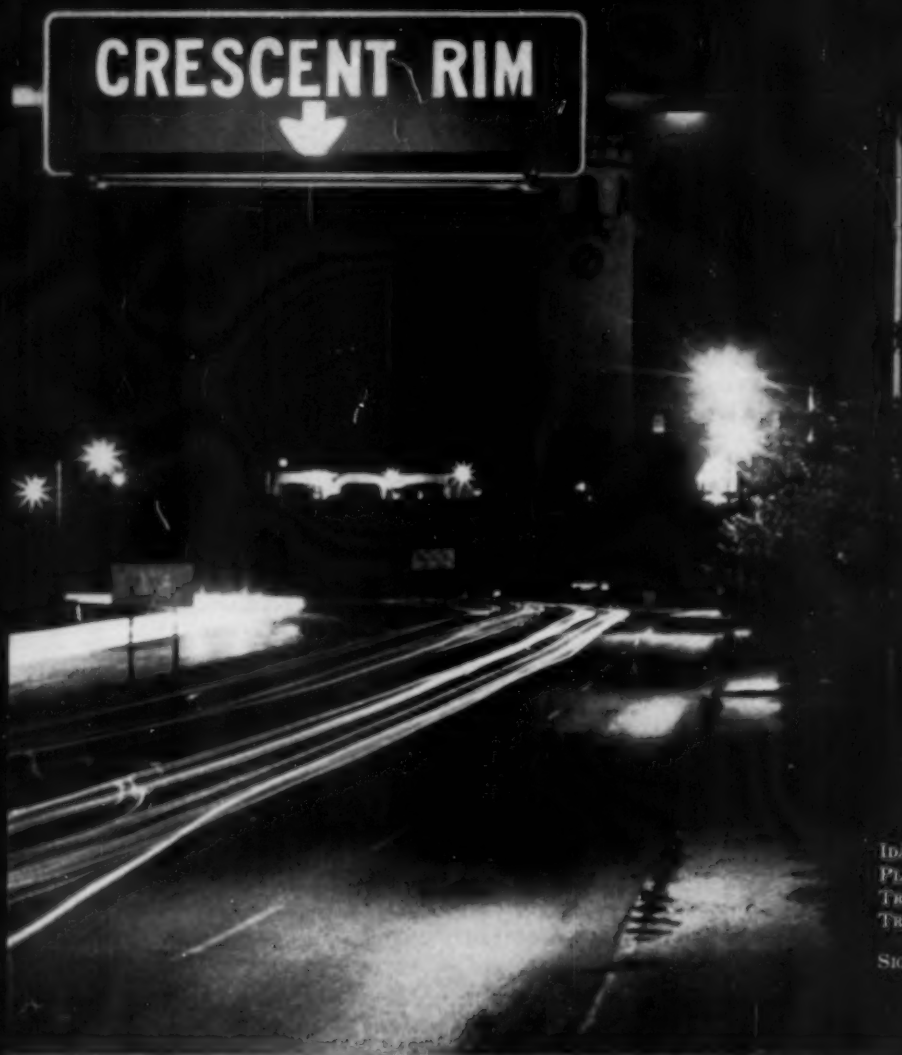


High Density overlaid plywood needs no protective painting; color (black, brown or amber) is in the overlay. Medium Density is for plain painted signs. Base panel is waterproof Exterior plywood.

and replacement costs of overlaid fir plywood



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TRAFFIC ENGINEER: M. W. Lotspeich
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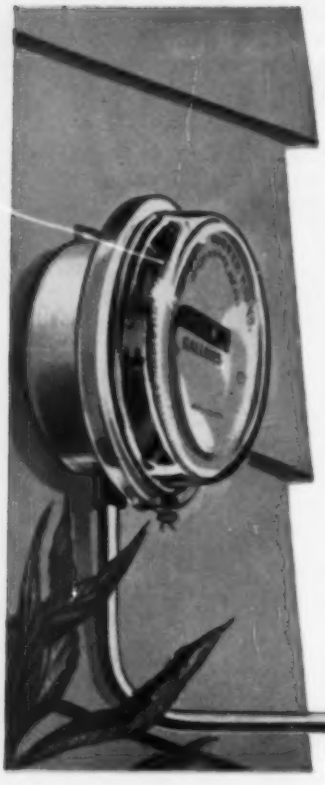

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COMMUNICABLE DISEASE IN WORLD WAR II

This is volume IV of the history of communicable disease incidence and control as reported by the Army during World War II. This volume refers to diseases transmitted chiefly through respiratory and alimentary tracts and discusses these primarily from the viewpoint of preventive medicine. There are 544 pages. The cost is $5.50 per copy. Edited by Office of the Surgeon General, Dept. of the Army, Washington 25, D. C.

CHICAGO'S 5-YEAR CAPITAL PROGRAM

This 164-page report covers the Chicago capital improvements program for the years 1959 to 1963, inclusive. It outlines the plans to provide improved facilities and service through issuance of $66 million of general obligation bonds and the use of revenue bonds, motor fuel tax funds and other sources. The proposed expenditures through 1963 total $708 million. Included are expressways, bridges and viaducts, streets and street lighting, traffic signals, airports, water filtration and distribution, sewers, incinerators and parking facilities. These programs are discussed and presented in detail in 13 chapters. The study was prepared by the Capital Improvements Program Division of the Department of City Planning under the general direction of Richard J. Daley, Mayor of Chicago.

PAVEMENT DESIGN PRINCIPLES

This is a new and excellent book on pavement design. The 20 chapters are treated in five parts and a summary of these will give as good a measure of the book as is possible in any review. Part I covers fundamental principles—pavement types and wheel loads, stresses in rigid and flexible pavements, pavement behavior under moving loads, climate and rigid pavement pumping. Part 2 treats pavement properties—soils, subgrades, stabilization, granular bases, shoulders and bituminous surfaces. Part 3 is the design of flexible pavements, with separate chapters on airport pavements (54 pages) and on highway pavements (46 pages). Part 4, the design of rigid pavements, also covers airport and highway pavements in separate chapters and includes a chapter on joints and reinforcing. Part 5 is devoted to pavement evaluation and strengthening, with chapters on surveys, evaluation and design criteria establishment, and on strengthening. Plenty of references are included. Overall, the book is an excellent job and every highway engineer should have easy access to a copy. By E. J. Yoder, Associate Professor of Highway Engineering and Research Engineer, Joint Highway Research Project, Purdue University. Well illustrated; 555 pages; John Wiley & Sons, Inc., 440 Fourth Ave., New York 16, N. Y.; $13.25.

TRIP CHARACTERISTICS AND TRAFFIC ASSIGNMENT

This 135-page booklet contains 13 papers presented at open sessions or during committee meetings of the latest annual meeting of the Highway Research Board. Copies are $2.60 each from the Board at 2101 Constitution Ave., Washington, D. C.

INSPECTING WELDED HIGHWAY BRIDGES

This publication includes information most frequently required by the engineer and inspector on welded bridge construction. Following a glossary of welding terms and symbols are the following:

Summary of inspector's duties and steps to be followed in inspection; interpretation of drawings and specifications; objections, methods and sequences; distortion and defects; safety and protective equipment; and bibliography. Special report No. 45; 72 pages; $1.60. Highway Research Board, Washington 25, D. C.

ORSANCO REPORTS ON THE OHIO RIVER

The eleventh annual summary of the accomplishments of the Ohio River Valley Water Sanitation Commission makes good reading; and it also shows what can be accomplished by such an agency headed by an energetic and able engineer. In addition, the report is very attractively designed and prepared. In municipalities on the Ohio, 95 percent of the population now have sewage treatment plants, as compared to one percent eleven years ago. Of the communities on the watershed, 82 percent of the sewered population are served by treatment plants. You should read this story of accomplishment yourself. Ask E. J. Cleary, Orsanco, 414 Walnut St., Cincinnati 2, Ohio, for your copy.

CHEMICAL INDUSTRY FACTS BOOK

This is the fourth edition of the Chemical Facts Book. It gives a great deal of information on what the chemical industry is, what it does and how its products are used by industry and for modern living. It contains a glossary of common chemical terms which may be useful. 158 pages; $1.25; Manufacturing Chemists' Assn., Inc., 1825 Connecticut Ave., NW, Washington 9, D. C.

SEWAGE WORKS JOURNAL 10-YEAR INDEX

A new Ten-Year Index is now available for Sewage and Industrial Wastes. This is for the decade ending Dec. 1958, and extends the indexing covered by the 20-year Index published in 1948. As with its predecessor volume, this Index provides the key to much specialized information on wastewater collection and treatment. The 10,000 entries result from a detailed search of the 10 volumes, and the key words selected are those believed to be the most helpful to the reader. The Index covers all original contributions and pertinent notices published; in addition, it includes subject and geographical indices for abstracts published over the 10-year period. Obtainable from the Federation of Sewage and Industrial Wastes Associations, 4435 Wisconsin Ave., NW, Washington 16, D. C. $4 for buckram; $3 for paper binding.

1959 HIGHWAY RESEARCH BOARD PROCEEDINGS

This is a big book of 669 pages covering the Proceedings of the 38th annual meeting held in Washington in January, 1959. The section headings are as follows: Economy, Finance and Administration, 73 pages; Design, 282 pages, 11 papers and reports; Materials and Construction, 108 pages, 6 papers and reports; Maintenance, 16 pages, 2 papers; Traffic and Operation, 96 pages, 5 papers and reports; and Soils, Geology and Foundations, 75 pages, 3 papers and reports. No price given. Highway Research Board, 2101 Constitution Ave., Washington, D. C.

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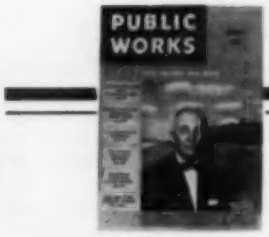


Wilbur J. Garmhausen is Chief Landscape Architect of the Ohio State Department of Highways, a position he has held since 1949. He was graduated from the Ohio State University with a major in Landscape Architecture. Following work with private organizations, he was with the C.C.C. in the Hocking County State Parks where he designed the layout for all of the seven areas. In 1935 he entered State Highway employment as a Division Landscape Architect in the Chillicothe Division of the Ohio Highway Department. In 1947, he was transferred to the Central Office. In regard to his work there, he says: "I have promoted the use of new kinds of equipment and material for easier and more economical maintenance.

"New ideas in design in Roadside Improvement have resulted in safer and more restful driving for the motorist. Ohio's Roadside Rest program on the Interstate Highway was the first to be developed; and Ohio became the leader in completeness of design and in number and use. It was natural that our design and development should become accepted and adopted as a part of the AASHO standards for Roadside Rests in the Interstate Highway System.

"I am Chairman of the Roadside Development Committee of the Highway Research Board and a member of the Executive Committee of the Roadside Development Committee for the AASHO. I am also a member of Roadside Improvement Committee of the ARBA. I am coordinator of the Ohio Roadside Development Short Course which is nationally recognized as the nation's outstanding conference on roadside development. Here an attempt is made to bring into focus all of the modern concepts of roadside development in its relationship to the complete highway."

He is active in Boy Scout work having received the much coveted "Silver Beaver" award for outstanding and dedicated service; and in community activities. He is a ruling elder in the Presbyterian Church. He and Mrs. Garmhausen have three children.

Protect against accidents like this!

Use straight Morton Rock Salt—the most effective way to help keep streets, freeways and tollroads safer in winter

Straight Morton Rock Salt does the job abrasives and Salt mixed with abrasives can't do to help prevent accidents caused by ice and snow. Morton Rock Salt gives *abrasive traction* against skidding even before the salt starts to melt the ice. Rock Salt crystals are larger than other commonly used ice melting chemicals and *penetrate ice deeper* with a corkscrew action—not just melt surface ice. Due to Rock Salt's better penetration, it reaches the pavement fast and quickly *melts* the bond between ice and the street surface.

Morton Rock Salt is safe, clean, economical

Straight Morton Rock Salt is non-toxic. It does not damage animals' paws, rubber, fabrics, leather, asphalt, brick or properly seasoned concrete. It will not clog sewers or leave a rutted, dirty pavement as will sand or cinders. What's more, Rock Salt melts *more ice at lower cost* at any temperature above 8° F. than any other commonly used ice melting chemical.

Send for more information today!

☐ Please send me your free book on ice and snow removal.

☐ I would like a Morton representative to advise me on how best to stockpile Morton Rock Salt.

Name_____

Title_____

Address_____

City_____ Zone____ State_____

MORTON SALT COMPANY

INDUSTRIAL DIVISION

Dept. PW-1, 110 No. Wacker Drive, Chicago 6, Illinois

Match tractor sizes to your jobs

Trucks fill fast when loaded with a 45 hp* International 340 Utility equipped with Fast Reverser and exclusive new International Wagner side and front-dump bucket.

KEY INTERNATIONAL TRACTOR SPECIFICATIONS

Tractor model	Max. Flywheel horsepower*	No. of cyl.	Belt horsepower*	Drawbar horsepower*	LP Gas engine	Diesel engine	Base working weight, lb†	Speeds forward	Hydraulic pump capacity gpm	Power Steering
Cub Lo-Boy	13.4	4	10.75	10.08	—	—	1,895	3	2.8	—
I-240 Utility	38.5	4	32.24	28.91	—	—	3,637	4	9.3	yes
I-340 Utility	45.0	4	35.24	32.41	—	—	4,365	5 or 10ƒ	9.3, 12, or 17	yes
T-340 Crawler	45.0	4	35.00	31.00	—	—	5,600	5 or 8ƒ	9.3, 12 or 17	—
I-460 Utility	61.0	6	52.43	48.16	yes	yes	5,255	5 or 10ƒ	12 or 17	yes
I-560	72.5	6	65.25	59.47	yes	yes	6,563	5 or 10ƒ	12 or 17	yes
I-660	95.0	6	80.00	72.00	yes	yes	8,180	5 or 10ƒ	12 or 17	yes

*At standard sea level conditions

ƒwith Torque Amplifier Drive
†with 175-lb operator, no added weight

Three six-cylinder power ratings, 61 to 95 hp*! Each is available with gasoline, Diesel, or LP Gas engine. Super-smooth "sixes," almost vibration-free, are far less fatiguing to operate and help step up daily output. Below, the 61 hp* International 460 Utility with International Wagner loader and backhoe.

Three four-cylinder power ratings, 13.4 to 45 hp*! Economical four-cylinder engines are real fuel-misers with high-torque design that keeps them on-the-drive under heavy load. Below, the economical 38.5 hp* International 240 Utility with seven-gang reel mower.

Your lowest-cost power buy for all-around utility, the International Cub® Lo-Boy®, left, and its running mate, right, the higher clearance Farmall Cub®. Both Cubs are equipped with 60-inch, center-mounted International Danco rotary mowers.

Internationals can make your 1960 budget go further

International's complete lineup of utility power can stretch next year's budget. Seven power sizes—13.4 to 95 hp*—provide power for the widest range of utility duty. Rate your power needs job by job and you'll find an International sized, priced, and powered to match.

Built-in brawn provides an extra margin of dependability—insures continued stand-up performance under rated maximum loads. An unexcelled power-weight ratio turns International brawn into improved traction that keeps operations on schedule. Job-matching options such as power steering, Torque Amplifier Drive, Fast Reverser, and fast-acting hydraulic systems cut costly time off jobs.

Unit-matched equipment—backhoes, loaders, blades, scrapers, and other equipment as well—take full operating advantage of International's greater built-in brawn to speed heaviest work.

Maximum flywheel horsepower

New low-cost International T-340 crawler delivers 45 hp*! It provides power, speeds, job range, and handling ease new to small crawler operations. New planetary-type steering plus production-boosting options such as Torque Amplifier Drive or Fast Reverser insure top-capacity performance.

SEE YOUR **INTERNATIONAL HARVESTER** DEALER

International Harvester Products pay for themselves in use—Farm Tractors and Equipment ...Industrial Tractors...Motor Trucks...Construction Equipment—General Office, Chicago 1, Ill.

FOR THE FULL STORY...
International Harvester Company, Dept. PW-1
P. O. Box 7333, Chicago 80, Illinois.

Please send me information on

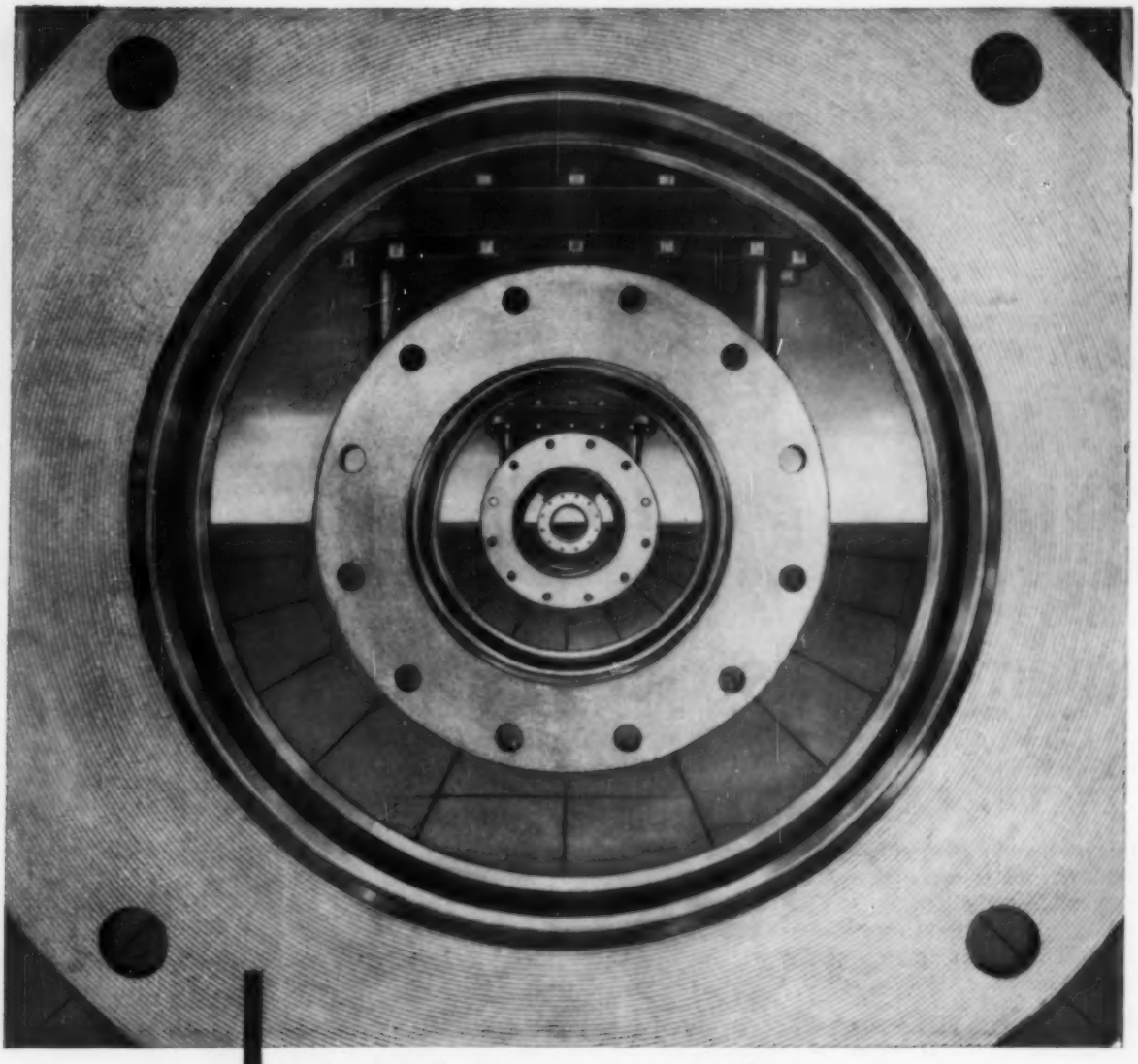
- ☐ 13.4 hp International Cub Lo-Boy
- ☐ 38.5 hp International 240 Utility
- ☐ 45 hp International 340 Utility
- ☐ 45 hp International T-340 crawler
- ☐ 61 hp International 460 Utility
- ☐ 72.5 hp International 560
- ☐ 95 hp International 660

Name

Title

Street and No.

P.O. State



Through these Gate Valves pass the best-regulated streams in the World!

The sound design and quality workmanship of Ludlow gate valves and Rensselaer gate valves is a guarantee of *lasting* ease of operation. Watertight closure is assured through years of trouble-free performance.

Write for the L&R Gate Valve Catalogs, showing the most complete selection of outstanding design features available today. Ludlow and Rensselaer double disc gate valves meet all requirements, including A.W.W.A. specifications, in sizes from 2" to 72", plus custom designing for special applications.

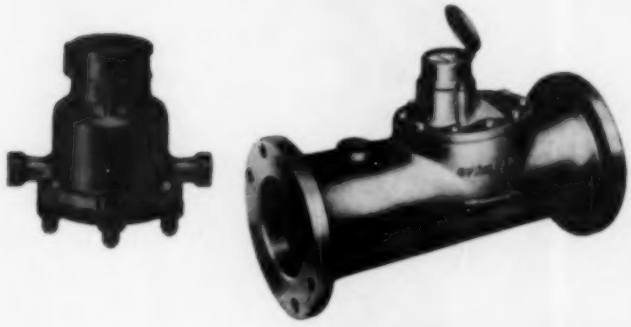
LUDLOW & RENSSELAER

VALVES AND HYDRANTS

THE LUDLOW VALVE MANUFACTURING CO., INC., TROY, N.Y.—SINCE 1861

Announcing

A NEW NAME IN THE WORLD OF WATER METERS



On January 1, 1960 two of the oldest and best-known names in the field of water measuring equipment joined forces.

Hersey Manufacturing Company of Dedham, Mass., and Sparling Meter Company of El Monte, Calif., have merged under the name Hersey-Sparling Meter Company, with executive offices in Dedham, Massachusetts.

The new organization supplies meters ranging from small household models up to meters for pipe as large as 19 feet in diameter.

HERSEY-SPARLING
METER COMPANY

DEDHAM, MASSACHUSETTS

● *Branches In Principal Cities*

Albuquerque's traffic engineering department finds:

"ALUMINUM

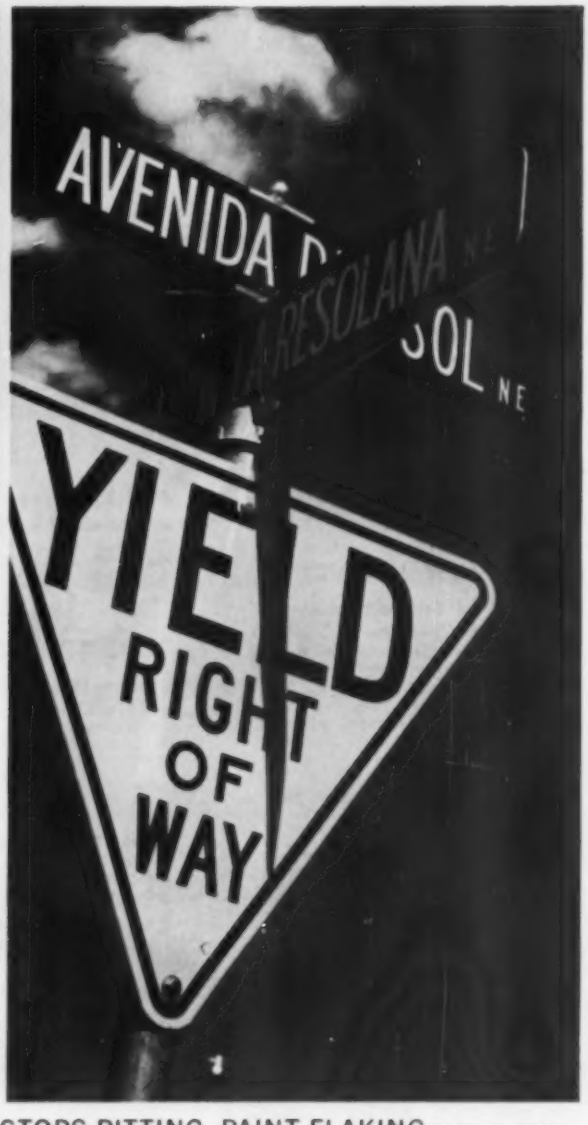
SAVES ON INSTALLATION, UPKEEP—Only aluminum mast arms come in 25-ft lengths needed to swing traffic signals out over the center lanes of Albuquerque's 86-ft wide streets. Faster, easier installation of lightweight aluminum, plus elimination of upkeep, repays its premium cost fast. And once aluminum signal heads are up, there's no repainting with its high cost and bottling-up of traffic. For corner-mounted signal posts, installation is a one-man job, while setting a 200-lb steel post ties up a three-man crew.

LOOKS GOOD IN MANY STYLES—Over 1,500 aluminum lighting standards now grace the streets of Albuquerque. Attractive, durable and maintenance-free, they cost less to ship and handle, go up faster with less man power. Many available styles give lighting engineers a wide choice of standards, brackets and luminaires.

"First cost is not our only consideration in recommending highway equipment," says Mr. Edwin Beck, Administrator, Traffic Engineering Department, of Albuquerque, N. M. "We analyze total cost for the entire economic life of a proposed installation, taking into account low maintenance and long service. That's why we ask for—and get—aluminum!"

Alcoa® Aluminum can stretch your tax dollars despite today's high-soaring costs.

COSTS LESS PER YEAR!"



MAKES FIRST COST YOUR LAST COST—Alcoa Aluminum bridge railing stays bright even in coastal and industrial areas, eliminates painting costs, which may run as high as a dollar per lineal foot each year. High-strength aluminum alloys provide an added safety factor, yet installation is fast and easy . . . just assemble and bolt in place.

STOPS PITTING, PAINT FLAKING—In the spring, Albuquerque experiences winds of such high velocity as to have a virtual sand-blasting effect on traffic control signs. Experience there has proved that aluminum will effectively withstand pitting from the grit carried by these blustery spring winds; other materials just don't stand up. Some 4,500 Albuquerque street-name installations are aluminum, too, because paint holds on tighter to aluminum, even through strong, ultraviolet ray exposure at the city's 5,000- to 6,000-ft elevation.

In bridge railings, lighting standards, traffic signs and signal heads, aluminum's light weight saves on installation; its resistance to corrosive moisture, salt and fumes ends maintenance and appearance problems for good. Let Alcoa's jobber-erectors and Alcoa's technical experts show you how to move *more* traffic at *less* cost with highway products of Alcoa Aluminum. For help with your own problems, write Aluminum Company of America, 1912-A Alcoa Building, Pittsburgh 19, Pa.

ALCOA ALUMINUM

Your Guide to the Best in Aluminum Value

For exciting drama watch "Alcoa Presents" every Tuesday, ABC-TV, and the Emmy Award winning "Alcoa Theatre" alternate Mondays, NBC-TV

Equipment and Materials *for your* PUBLIC WORKS PROGRAM

The engineering information in these helpful catalogs will aid you in your Engineering and Public Works programs. Just circle numbers you want on the reply card, sign and mail. This free Readers' Service is restricted to those actively engaged in the public works field of cities, counties or states.

NEW LISTINGS

Putting Small Sewage Treatment Plants in the "Big Time"

557. Four equipment units that get big plant results in small plant operation are featured in an 8-page booklet "Small Plant Sewage Treatment." Drawings and flow sheets give the details. Write Dorr-Oliver Inc., Stamford, Conn. for Bulletin 6692 or use the reply card.

To Increase Your Public Works Efficiency

561. Ask now for the new "Modern Methods and Equipment" booklet that spells out how other officials have applied IH equipment to everything from earth moving and trenching, from snow plowing and road building to pipe laying and electric power plants. Write International Harvester Co., 180 N. Michigan Ave., Chicago 1, Ill., or check our card.

You May Avoid Ownership But Not Paying For It

563. Makeshift approaches to concrete cutting mean lots of labor and exasperation. To find out what a concrete saw will save you in time and effort on pavement cutting, trench patching and similar work, get the new four-color brochure on concrete saws and blades from Eveready BrikSaw Co., Dept. 626, 1104 Union Ave., Kansas City 1, Mo.

When You Measure Don't Lose Your Head

564. Head of water pressure, that is. There's a new propeller meter now, dedicated to just that. A new Bulletin, MR-105 tells how. You get it by writing Measure-Rite, Incorporated, a subsidiary of Badger Meter Mfg. Company, 701 S. Garfield Ave., Alhambra, Calif., or circling our card.

Special Valves Handle All Filter Plant Functions

573. Valves designed for the specific functions of water filter backwash, surface wash, rewash and drainage—subject to hydraulic, electric or pneumatic operation from control tables —are described in Bulletin W-18 of Golden-Anderson Valve Specialty Co., 1244 Ridge Ave., Pittsburgh 33, Pa. Circle reply card.

Let Progress Hit Your Highway Signs, too

575. An overlaid plywood especially engineered for highway sign construction is now available in natural surface for reflective overlays, also in green or white. AASHO approved. Resistance to damage cuts maintenance costs. For GPX description and specifications write Georgia-Pacific Corporation, Equitable Bldg., Portland 4, Oregon, or circle number on our card.

For Soil Sampling and Pavement Coring

576. There's an easier way to do both with Acker equipment. Bulletin 26-R describes a kit containing 12 different soil sampling tools. Bulletin 40-R tells about the All-Purpose auger for all types of sub-surface exploration. Bulletin 700-R illustrates the Acker Shear Test Kit for in-place shear tests in soft areas. Name the ones you want. Acker Drill Company, Inc., Box 830, Scranton, Pa., or check our card.

Regulate Digester Gas Use and Costs too . . .

577. with Gas Control equipment described in this new Bulletin S-7301. Includes data on several new products that are news and point the way to better sewage plant operation and lower costs. Write The Vapor Recovery Systems Company, 2820 N. Alameda St., Compton, Calif.; or just circle the number on our card.

For the Busy Engineer . . .

587. who is interested in hydrologic instruments, here's help in a new "short form" catalog. Gives you illustrated data on liquid flow and level indicators and recorders, with brief summary of their uses. Full of useful and provocative ideas. Write Leupold & Stevens Instruments, Inc., 4445 N.E. Glisan St., Portland 13, Ore., or circle our card number.

What's New in Butterfly Valves?

589. More than you know until you get the latest data contained in this new Bulletin 10 T describing the Pratt Monoflange Mark II Rubber Seat valve. Includes complete specifications, dimension drawings, water and gas flow data; even prices. Henry Pratt Company Incorporated, 319 West Van Buren St., Chicago 7, Ill.

New Light on Sludge Heaters . . .

590. is contained in this new Bulletin No. 1001 describing principle of operation, design and construction features, performance and dimension data, etc. Better get it now for quick or future reference, from Ralph B. Carter Co., 193 Atlantic St., Hackensack, N. J.

If Water Control Gates are Important to You . . .

592. this new 4-page fact-packed illustrated folder will be important too. Armco anticipates your questions and answers them helpfully in it. Just write for folder G-12059, Product Information Service, Armco Drainage & Metal Products, Inc., Middletown, Ohio; or circle above number on our card.

Every Pre-Stresser will be Impressed . . .

593. with the wealth of facts and figures in this 20-page booklet with studies of 16 outstanding prestressed concrete projects ranging from bridges to tanks. Ask for your copy of Bulletin MBR-P-13 from The Master Builders Company, Cleveland 3, Ohio. Or—easier—just circle the number on our card.

Latest "Secret Weapon" for Concreting . . .

597. is the Refract-All Gun for faster, easier concreting on pools, tanks, retaining walls, pavement repairs. Meters water, insures correct mix. Write for new booklet to Refract-All Manufacturing Co., 3703 E. 36th St., North, Tulsa, Okla., or circle card.

Save Wear and Tear on Eyes and Brains . . .

598. by using RC and RCH Trafcounters to record vehicle volume, around the clock. Handle every aspect of traffic counting and recording. Three folders tell all. Write Streeter-Amet Co., Grayslake, Ill.- Or circle our number on the card.

Technical Bulletins to Design or Check by . . .

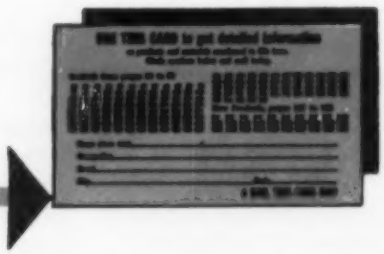
600. for water and sewage plants. They are now available as No. 100 on Venturi tubes; No. 720 on supervisory control; No. 1003 on mechanically operated rate-of-flow and loss-of-head gauges; No. 1004 on pneumatic single and double indicating receivers; and No. 1225 on controlled closing air valves. For the set, write Simplex Valve and Meter Co., Lancaster, Pa., or circle our card number.

King-Sized Catalog on Soil Testing Equipment

602. Largest in history, describes over 3,400 different items of soil testing equipment, with 1500 illustrations. 316 pages of useful data, referenced with ASTM and AASHO specifications and lists of recommended equipment for every job. Get your free copy by writing Soiltest, Inc., 4711 W. North Ave., Chicago 39, Ill., or circle this number on card.

Play Safe with Automatic Controls

603. Remote engine and pumping controls of every sort are fully described in a series of bulletins offered by Synchro-Start Products Inc., 8151 N. Ridgeway Ave., Skokie, Ill. Write them or circle the above number on our card.



. . . is cut to a minimum when you treat gravel roads with Sterling Rock Salt!

As aggregate gets scarcer and rises steadily in price, more and more highway departments are using economical Sterling Rock Salt to treat gravel roads. This treatment, which binds aggregate and other road materials tightly together, more than pays for itself through savings in aggregate alone. Additional savings are possible because damage to the wearing course is greatly reduced, and roads usually require nothing more than routine blading every spring.

Special equipment is no longer needed for effective salt treatment of gravel roads. Last year, International Salt Company introduced a simple, practical 7-step method which is fully described in a free booklet, "Better Roads." Send today for your free copy, and learn how Sterling Rock Salt treatment can work in your area.

Service and research are the extras in

STERLING ROCK SALT

INTERNATIONAL SALT COMPANY, INC.

International Salt Company, Inc.
Department PW-160
Clarks Summit, Pennsylvania

☐ Please send free booklet, *Better Roads.*

☐ Have a Sterling representative call.

*Name*_____

*Address*_____

*City*_____ *State*_____

To order these helpful booklets check the reply card opposite this page.

NEW LISTINGS (Cont.)

Pumps of Many Types for Sewage and Sludge

604. Marlow-made for every rugged service. Many types, from plunger to diaphragms to self-priming centrifugals. All described in a clean cut Bulletin No. W-59. Address Marlow Pumps Div., Midland Park, N. J. Or check our card.

Put Traffic Signals Out Where They Can be Seen

606. A 20-page booklet points out how to do this most effectively, gives fullest detail. Follow it and more motorists will love you. As first step, ask for Catalog TE-1 of Pfaff & Kendall, 84 Foundry St., Newark 5, N. J., or circle number on our card.

Keeping Up-to-Date on Fire Hydrants . . .

608. will be made more certain by having this latest folder on Iowa hydrants in your files. Dependable design; ground line break flange construction. Ask for Bulletin X9 of Iowa Valve Co., Oskaloosa, Iowa, or circle the reply card.

When you Specify Submersible Pumps . . .

612. the task will be easier for having the new Kenco Pump Division Catalog-Data File handy. 32-pages, fully illustrated and indexed, with all the data you need right in it. Ask for it by writing Kenco Pump Division, 1305 Oberlin Ave., Lorain, Ohio.

Fits into Your Present Traffic Control System

614. Here is a new kind of control for your traffic signals. Establishes proper synchronization and time cycles for many varying traffic conditions. Includes all standard features and adds new ones. To learn what you may be missing in traffic control, write for Selectrol folder, Littlefield-Alger Signal Co., Rockville Centre, N. Y.

This Metering Pump Can't Cook . . .

613. but you will find it complete with features for water service. Heavy duty design, capacities from 0.65 to 2025 gph. Utter accuracy, corrosion-resistant, versatile. Series 200 is its identification. Write Wallace & Tiernan Inc., Belleville 9, N. J., for new fact-filled brochure. Or circle our number on card.

When the Frost is on the Meter

615. If it is an American frost-bottom meter freezing is no major problem. The replaceable center section breaks out leaving the mechanism undamaged. Bulletin 58 tells the story. Address Buffalo Meter Co., Inc., 2917 Main St., Buffalo 14, N. Y., or circle reply card.

Use The Reply Card

The Tractors that Put the Utility into Utility Tractors

618. Low profile, high clearance, and a new Shuttle clutch, power steering are a few features. For the full story write Allis-Chalmers Mfg. Co., Milwaukee 1, Wis., for Utility Tractors literature, or circle our card-number.

A Breakthrough in Vacuum Filtration

622. To bring you up-to-date on the Eimco continuous belt drum filter, this new booklet covers design, application and actual case histories. Sewage plant designing engineers will find it highly useful. Write The Eimco Corp., 634-666 South 4th West St., Salt Lake City 10, Utah, or circle the number on our card.

From Sludge to Ashes

626. A process described in attractive detail in this new brochure on sludge handling and incineration in sewage plants with Nichols Herreshoff Multiple Hearth Sludge Furnaces. Your copy of this No. 238 bulletin may be had by writing Nichols Engineering & Research Corp., 70 Pine St., New York 5, New York.

Color Catalog Describes "Michigan" Tractor Dozers

631. A 20-page catalog on "Michigan" Models 180, 280 and 380 tractor dozers covers the design and operating features and explains how the hydrulic controls regulate all dozer operations. For your copy write to Construction Machinery Div., Clark Equipment Co., P. O. Box 599, Benton Harbor, Mich., or check the reply card.

Information on Trucks for Every Job

632. Literature on the complete IHC truck line is available from Interntional Harvester Co., 180 North Michigan Ave., Chicago 1, Ill. Included is information on basic models, conventional and COE, 4-wheel, 6-wheel and four-wheel-drive. Check the reply card.

Cushman Truckster Delivers Greatest Light Hauling Economy

636. Complete information on the Cushman Truckster is available from Cushman Motors, 900 No. 21st, Lincoln, Nebr. Features are choice of body styles, formed channel chasis, constant mesh transmission and hydraulic brakes, 12-volt lighting system, etc.

Give a Lift to Your Sewage

638. With the new advanced-design TEX-VIT packaged pump station. Full of new features that make for efficiency in pressure controls, improved air circulation based on superior components. For names of municipal users, and Bulletin PS-60 just address TEX-VIT Supply Co., Manufacturing Division, Mineral Wells, Texas, or circle the number on our card.

New Powerful Rotary Cutter for Heavy Duty

639. Specially designed for land-clearing, mulching and right of way maintenance. Exclusive features include shielded fly wheel for delivery of steady power flow, ability of cutter to ride over obstacles without affecting cutter action. For Jeeps or 3-point lift type tractors. Get the full story from W. F. Covington Planter Co., Dothan, Ala. or circle the number on our card.

Synchro-Start's new protective engine controls have been designed, for the starting and stopping of engines from remote pilot devices, such as pressure switches, float switches, power failure relays, etc., and are completely automatic in operation. These dependable controls are encased in a steel, dust proof cabinet, and now feature enclosed PLUG-IN RELAYS as well as OVERLOAD BREAKERS. The plug-in relays simplify what little field maintenance that may have been required in older models, while the overload breakers eliminate the necessity of replacing fuses.

In designing this unit we have used the same high quality materials and workmanship that our customers have come to expect throughout Synchro-Start's 27 years of manufacturing engine controls.

SYNCHRO-START PRODUCTS, INC.

Your Choice for Convenience in PITTSBURGH

HOTEL PITTSBURGHER

Right in the heart of the Golden Triangle 400 outside rooms with TV and every comfort of modern hotel design. General Forbes Lounge and Dining Room . . . Air Conditioning. Airport Limousine and Taxi Service.

Forbes Avenue Below Grant

ATlantic 1-6970

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The very finest accommodations. 60 air-conditioned rooms with TV, telephone, combination tile baths. Excellent dining room. Facilities for group parties 15 to 500.

Route 30 Irwin, Pa.

1 mile West of Irwin Interchange

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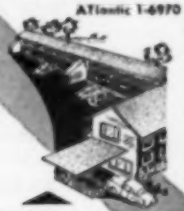

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Joseph F. Duddy, Gen. Mgr.

HOTEL PITTSBURGHER MOTEL

Opposite Greater Pittsburgh Airport on beautiful Airport Parkway West. 56 luxurious, air-conditioned rooms with tile bath, TV, private phone. Courtesy car to and from airport.

AMherst 4-5152

* Teletype Service. For immediate confirmation of reservations at no charge . . . telephone any Knott Hotel—or teletype PG-29.

"Gosh darn it, Marino, you've been putting too much rubber powder in the asphalt mix!"

BOUNCE THOSE OUTDATED BOOKLETS, TOO . . . GET NEEDED NEW ONES.

The system below makes it easy to get helpful catalogs and information on new products

- Each item has a number
- Select the ones of value to you
- Circle the numbers, sign and mail

January 1960

USE THIS CARD to get detailed information . . . . .

Please send me literature on the following items described in PUBLIC WORKS:

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169 182 183 188 189 190 192 194 208 209 211 213 222 224 228 236 247 249 250 261 262 269 263 272 277 288 289 298 303
305 317 318 322 329 330 331 342 348 389 370 384 386 414 415 419 426 430 432 439 461 462 478 480 503 510 527 535 546
551 564 567 581 583 584 593 598 596 597 585 586 587 588 589 590 592 593 597 598 600 601 602 603 604 606 607 608 609
612 613 614 615 617 618 622 626 631 632 636 638 639 641 645 646 650 660 669 671 672 677 681 684 689 696 699 713

New Equipment Items Appear on Pages 172 to 177

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For prompt results, use this card today.

Meetings and Conventions

14th Annual Northeastern Weed Control Conference
Hotel New Yorker
New York, N. Y., Jan. 6-8

39th Annual Meeting
Highway Research Board
Washington, D. C., Jan. 11-15

American Road Builders' Assoc.
Cincinnati, Ohio, Jan. 18-20

New York Section, FSIWA
Park Sheraton Hotel
New York, N. Y., Jan. 20-22

Associated Equipment Distributors
Conrad Hilton Hotel
Chicago, Ill., Jan. 24-28

New York Section, AWWA
Park Sheraton Hotel
New York, N. Y., Jan. 26

Utah Section, FSIWA
University of Utah
Salt Lake City, Utah, Feb. 1

Indiana Section, AWWA
Sheraton-Lincoln Hotel
Indianapolis, Ind., Feb. 2-5

Texas Section, FSIWA
Memorial Student Center
College Station, Tex., Feb. 28-Mar. 4.

Mississippi Section, FSIWA
R. E. Lee Hotel
Jackson, Miss., Mar. 4

Arkansas Section, FSIWA
Marion Hotel
Little Rock, Ark., Mar. 13-16

American Concrete Institute
Hotel Commodore
New York, N. Y., Mar. 14-17

Illinois Section, AWWA
Pick-Congress Hotel
Chicago, Ill., Mar. 16-18

23rd Annual Short Course for Superintendents and Operators of Water and Sewerage Systems
State University
Baton Rouge, La., Mar. 16-18

New England Section, AWWA
Statler Hotel
Boston, Mass., Mar. 17

Southeastern Section, AWWA
DeSoto Hotel
Savannah, Ga., Mar. 20-23

West Virginia Sections, AWWA & FSIWA
Hotel Pritchard
Huntington, W. Va., Mar. 23-24

Northwest Highway Engineering Conference
Oregon State College
Corvallis, Ore., Mar. 25-26

New Jersey Section, FSIWA
Traymore Hotel
Atlantic City, N. J., Mar. 30-Apr. 1

Association of Highway Officials of the North Atlantic States
Bellvue-Stratford
Philadelphia, Pa., Mar. 30-Apr. 1

New York Section, AWWA
Sheraton-Binghamton Hotel
Binghamton, N. Y., Apr. 5-7

Kansas Section, AWWA
Broadview Hotel
Emporia, Kan., Apr. 20-22

Nebraska Section, AWWA
Cornhusker Hotel
Lincoln, Nebr., Apr. 20-22

California Section, AWWA
Mark Thomas Inn
Monterey, Calif., Apr. 22

Kansas Section, FSIWA
Broadview Hotel
Emporia, Kans., Apr. 23-24

Arizona Section, AWWA
Pioneer Hotel
Tucson, Ariz., Apr. 28-30

Montana Sections, AWWA & FSIWA
Northern Hotel
Billings, Mont., Apr. 29-30

National AWWA
Bal Harbour, Fla., May 15-20

American Public Works Assoc.
The Coliseum
New York, N. Y., Aug. 14-17

Institute of Traffic Engineers
Edgewater Beach Hotel
Chicago, Ill., Sept. 11-15

Federation of Sewage and Industrial Wastes Assocs.
Philadelphia Sheraton Hotel
Philadelphia, Pa., Oct. 2-6

American Public Health Assoc.
San Francisco, Calif., Oct. 31-Nov. 4

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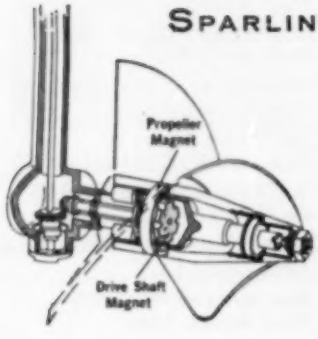
TOTALIZATION *and* RATE OF FLOW *at a glance*

SPARLING MASTERFLO MAIN-LINE METERS



DIRECT TOTALIZATION is the primary function of all Sparling Meters. The SPARLING MASTERFLO also shows *rate of flow* to give *complete* flow information instantly, accurately and continuously without the use of conversion tables or secondary instruments.

SUPERIOR PERFORMANCE of the MASTERFLO meter is a result of Sparling's exclusive magnetic drive. A combination of magnets in propeller and drive shaft permits entire gear box to be hermetically sealed. Vital parts are protected from corrosion, and without packing glands, friction is negligible. Accuracy is assured; maintenance is reduced; meter life is extended.

SPARLING MASTERFLO MAIN-LINE METERS represent the most advanced metering equipment in the water works field. Sizes 4" to 24" and suitable for 150 or 250 psi working pressure.

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WATER CONTROL EQUIPMENT

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East Coast Manufacturing Facilities, Dedham, Mass.

Atlanta 3 • Chicago 4 • Cleveland 13 • Dallas 1, Tex. • Denver 6 • Kansas City 6, Mo. • Roselle, N. J. • San Francisco 24 • Seattle 99 • Romford, England

United Kingdom Affiliate: TYLORS OF LONDON LTD.

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NEW LISTINGS (Cont.)

A Brand New Idea in Swimming Pools

641. Now you can get them factory-fabricated, ready to assemble, in thick plate sections of eternal aluminum. Lowest installation costs, by far the lowest costs per year. Immune to settling and soil shifts. Made by people with long years of successful know-how. For literature and address of a pool near you write Dept. P, Chester Products Inc., Belle Ave. and B&O RR, Hamilton Ohio; or circle on our card.

Manual on Solving Drainage Problems

645. An 80-page Manual on the problems of drainage and drainage materials is available. Design section includes determining culvert lengths and sizes, run-off calculations, excavation of base and backfilling data. Check the reply card or write Bethlehem Steel Co., Bethlehem, Pa., for the third revision of this valuable book containing new tables for evaluating flow fraction.

Get "Down to Earth" Quickly With Mobile Drill's "Explorer"

646. Multi-purpose drill augers to 75 ft.; core drills to 500 ft.; bores holes up to 24-in. diameter. Full details on this powerful yet lightweight unit from Mobile Drilling, Inc., 960 No. Pennsylvania St., Indianapolis 4, Indiana. Check the reply card.

BUSINESS ADMINISTRATION

Save Space By Filming Your Records

57. Microfilm your records by using the Recordak Microfilmer. Check the reply card or write Recordak Corp., 415 Madison Ave., New York 17, N. Y., for operation, use and price of this machine. Also available is literature on the Recordak Verifax Copier that makes certified copies 15 times faster than typing.

If You are Considering a Bond Issue Check with Chase Manhattan

236. For details on bond issues for any municipal or governmental unit, write The Chase Manhattan Bank, 40 Wall St., New York 15, N. Y. Check the reply card.

Monthly Time and Cost Record Book

249. To assist owners in determining the cost of owning and operating equipment Caterpillar Tractor Co., News Service, Peoria, Ill., has prepared a 24-page monthly time and cost record book. Twelve sets of pages are included on which to record day by day machine expenses for an entire year. Check the reply card for your copy.

RECREATION

Put the Kids on Rubber

36. ... and save bruises and bumps. "SAF-PLA" rubberized playgrounds make friends of parents and patrons. Can be applied to blacktop, concrete, etc. You owe it to the children to learn about "SAF-PLA." Write U. S. Rubber Reclaiming Co., Inc., Box 365, Buffalo 5, N. Y., or check the card.

How to Equip Your Parks and Playgrounds

414. A handsome 60-page illustrated catalog showing a full line of extra heavy duty playground, park picnic and dressing room equipment, plus many related items, is now available from American Playground Device Co., Anderson, Ind. Complete specifications, construction features, prices and details of labor and materials needed for installation are included. Check the reply card.

WATER WORKS

Do You Have An Independent Source of Electricity?

27. An independent source of electricity which will supply power for vital services when regular sources fail can be invaluable during emergencies. Check Kohler Bulletin KEP 56-1 which furnishes data that will help you select the plant best suited for your needs. Many models, 500 watt to 50 Kw, portable and stationary are described. Write the Kohler Co., Kohler, Wis., or use the reply card.

For Fast, Smooth Pipe Cuts

68. Descriptive literature on the Reed 4-wheel hinged pipe cutter which operates in close quarters, gives quick, easy right-angle cuts, and is available from Reed Mfg. Co., Erie, Pa. Check the reply card.

Efficient Coagulation With Ferri-Floc

69. Advantages claimed for Ferri-Floc as a coagulant include wide pH range, quick floc formation, manganese removal control of certain tastes and odors plus other aids in high quality water production. Check reply card for complete Ferri-Floc data. Tennessee Corp., Grant Bldg., Atlanta, Ga.

100 Page Book Helps Solve Water Problems

71. pH and Chlorine Control. A discussion of pH, Chlorine and Phosphate Control and descriptions of comparators for making colorimetric analyses. A 100 page booklet is available by checking reply card. W. A. Taylor & Co., 7304 York Road, Baltimore 4, Md.

For Prompt Service Use The Reply Card

Automatic Engine Control Equipment Manual

83. This catalog contains descriptions of standard automatic and semi-automatic controls and control equipment. General control recommendations, control selection chart, accessory selection chart, safety stop controls and alarm sets are sections covered. For price lists and models available write Synchro-Start Products, Inc., 8151 N. Ridgeway, Skokie, Ill.

Telemetering Links Transmitter and Receiver Over Any Distance

102. Bulletin #230-P4 describes how Builders-Providence Chronoflo telemeters enable users to observe and record the operation of widely scattered meters at a central location from any distance. Check the reply card or write B-I-F Industries, Inc., 345 Harris Ave., Providence 1, R. I.

Rapid Sand and Pressure Filter Data

109. Rapid sand filters. A complete line of vertical and horizontal pressure filters, wooden gravity filters, and filter tables and other equipment. For engineering data, write Roberts Filter Manufacturing Co., 640 Columbia Ave., Darby, Pa., or check the reply card.

Helpful Reference Catalog on Waterworks Gate Valves

146. All necessary details on Double Disc Parallel Seat Gate Valves for waterworks use are provided in the attractive 36-page bulletin issued by Ludlow Valve Mfg. Co., Inc., Troy, N. Y. Conveniently arranged design data shows all dimensions for 2" to 60" valves. Gearing, floor stands, operating devices are covered too. Get Bulletin 54W by checking the reply card.

AWWA Fire Hydrants and Gate Valves

155. Above-ground maintenance Mueller AWWA improved fire hydrants and minimum maintenance Mueller AWWA non-rising stem gate valves are described in literature from Mueller Co., Decatur, Ill.

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plants serve more than 85 percent of the U.S., assuring you of quick technical help when needed and fast delivery of such precast concrete products as:

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2. HI-HED PIPE is inherently stronger than its round pipe equivalent for use under extremely high fill. Makes full use of available cross-room without disturbing existing facilities.

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A-M's elliptical concrete pipe was chosen for this combination sewer project because of its increased self-cleansing velocities at periods of dry-weather flow—and used in three ways on this single job . . . as Lo-Hed, Hi-Hed and Inner Circles Pipe. The two mile line, engineered by Consoer Townsend & Associates, Chicago, runs from the Teletype Corporation in Niles, Illinois, to the north branch of the Chicago River.

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3. INNER CIRCLES PIPE allows passing of pipe through pipe underground without requiring excavations or disruption of surface traffic. Permits faster work at less cost in any weather.

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101 EAST ONTARIO STREET, CHICAGO 11, ILLINOIS, PHONE: WHITEHALL 4-5600

To order these helpful booklets check the reply card opposite page 36.

Wherever Water Flows, Steel Pipes It Best

26. Complete data on the use of steel pipe for water supplies are available from Steel Plate Fabricators Association, 105 West Madison St., Chicago 2, Ill. Check the reply card today.

Engineering Data On Mechanical Joint C.I. Pipe

183. General specification, weights and dimensions of mechanical joint cast iron pipe and fittings are furnished in a 32-page booklet issued by Alabama Pipe Co., Anniston, Ala. Get this helpful data by checking reply card.

Design of Prestressed Concrete Tanks

194. An 8-page technical Bulletin, T-19, on the Design of Prestressed Concrete Tanks, gives engineering data and formulas of general interest to anyone considering prestressed concrete for storage tanks. Check the reply card or write The Preload Co., Inc., 21 East 37th St., New York 16, N. Y.

Complete Catalog and Reference Data on Valves and Fittings

211. The entire M & H line of valves, fittings and accessories for water works, filtration, sewage disposal and fire protection are illustrated and fully detailed in Catalog 52 issued by M & H Valve & Fittings Co., Anniston, Ala. In addition to complete data on these products, there are many pages devoted to helpful engineering data. Every designer should have a copy.

Manual on Pipe Finding Techniques

213. A manual on special pipe finding and leak detecting techniques of interest to utilities, municipalities, oil and gas companies is announced by Fisher Research Laboratory, Inc., 1961 University Ave., Palo Alto, Calif. The manual contains a number of articles on locating buried pipes and cables and detecting and locating fluid leaks in pipe lines.

Meters and Instruments For Water Works

224. An attractively arranged 20-page booklet issued by Sparling Meter Co., 225 No. Temple City Blvd., El Monte, Calif., furnishes concise data on the full line of Sparling meters, indicator-totalizer-recorder instruments and other special instruments and controls. Check the reply card for your copy, or write for Bulletin 314.

Water Lines Under Pavements Easily Installed

247. With a Trojan pipe pusher and puller no resetting of grip is required, so the work goes twice as fast. Two models, for pipe up to 2" dia. The larger model is available with air power unit to eliminate manual pushing. Get full details by checking the reply card. Trojan Mfg. Co., 1114 Race Dr., Troy, Ohio.

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Accuracy In Chemical Proportioning

263. For chlorinating swimming pools or drinking water, for feeding polyphosphates, fluorides, soda ash, alum, or acids in water treatment where precise accuracy is required, consult the literature of Precision Chemical Pump Corp., 1396 Main St., Waltham 54, Mass.

There's More than One Way to Dig a Trench

318. Arps Corporation lets you choose. The ARPS tractor-mounted Trench Hog makes it cheaper, better to own your own trencher. Digs to 7 feet deep, 20" wide. Trench-Devil M-A has 7 appealing new features. Smaller Trench-Devil Jr. keeps you from sending a man to do a boy's work. Write Arps Corp., New Holstein, Wis. or check the card for bulletins.

Renew Pipe Performance With Cement Mortar Lining

323. Application of the Tate and Spunline process for cement mortar lining of existing pipe lines with a minimum of interruption of service is described, with diagrams, photographs and specifications in Catalog 15-58. Write to Pipe Linings, Div. of American Pipe and Construction Co., P. O. Box 457, Wilmington, Calif., or check the reply card.

Manual on the Hersey Disc Water Meter

329. Illustrations, descriptions and specifications of Hersey water meters are covered in manual available from Hersey-Sparling Meter Company, 250 Elm St., Dedham, Mass. Size ranges are ⅝"-¾"x⅝"-¾" and 1". Check the reply card.

Helpful Data on Water Meters

330. It is to the interest of every water works superintendent and engineer to have full data on dependable Badger water meters and related meter products. Complete data on all types of disc, turbine and compound meters, meter test equipment, yokes, strainers and alarm registers are supplied in an attractive binder by Badger Meter Mfg. Co., Milwaukee 18, Wisconsin.

Diesel Engines For Municipal Power Needs

339. Dependable power for water supply or flood control pumping stations, stationary or portable electric plants and many other municipal needs can be provided by engines described in literature of the Enterprise Engine & Machinery Co., 18th & Florida Sts., San Francisco 10, Calif.

Streamlined and Modernized Fire Hydrants

607. Models, dimensions and advantages of the Eddy fire hydrant are covered in bulletin from the Eddy Valve Co., Waterford, N. Y. Check the reply card for complete details.

ONLY POOL WARRANTED AGAINST RUST, CRACKS, AND LEAKS

CHESTER ALL-ALUMINUM POOLS

• Indoor and Outdoor Pools in Olympic and A.A.U. Standard Sizes Custom-designed for Clubs, Municipalities, Parks, Hotels, Institutions, Schools.

←T-Shape Chester pool at Washington Park, Kenosha, Wisconsin. 47' x 165' with 35' x 42' diving bay. Ground broken, May 6, 1959 — opened for swimming in less than 12 weeks. Chester DIAVAC Filter provides 325,000 gal. 6-hour turnover.

Assembled in a few days on the site from factory-fabricated battleship thick plate aluminum sections. Expert M.I.G. arc welding by factory technicians insures permanently water-tight joints.

Usually costs less to install than other types because prefabrication minimizes labor on the site. Exclusive built-in overflow and recirculating ducts also eliminate costly field piping.

Always costs less per year than any other pool because of the proven inherent imperviousness of aluminum to both interior and exterior corrosion . . . virtually no maintenance, no cracks or leaks. Proven by numerous industrial applications where only aluminum has withstood the assaults of strong chemicals. Proven by every battered aluminum pot that has endured vegetable acids for a decade or more in your kitchen. Proven for five years in pool installations from Texas to Canada.

Immune to settling and soil shifts, self-supporting. Engineered by specialists in aluminum and architectural fabrication for 15 years—tanks, weldments, crane booms, pedestrian bridges.

Small wonder that more architects, consulting engineers, and pool planning committees are now specifying the Chester All-Aluminum Pool after careful comparison of all types.

Write for literature and address of pool near you. Also Diavac Filters and Deck Equipment.

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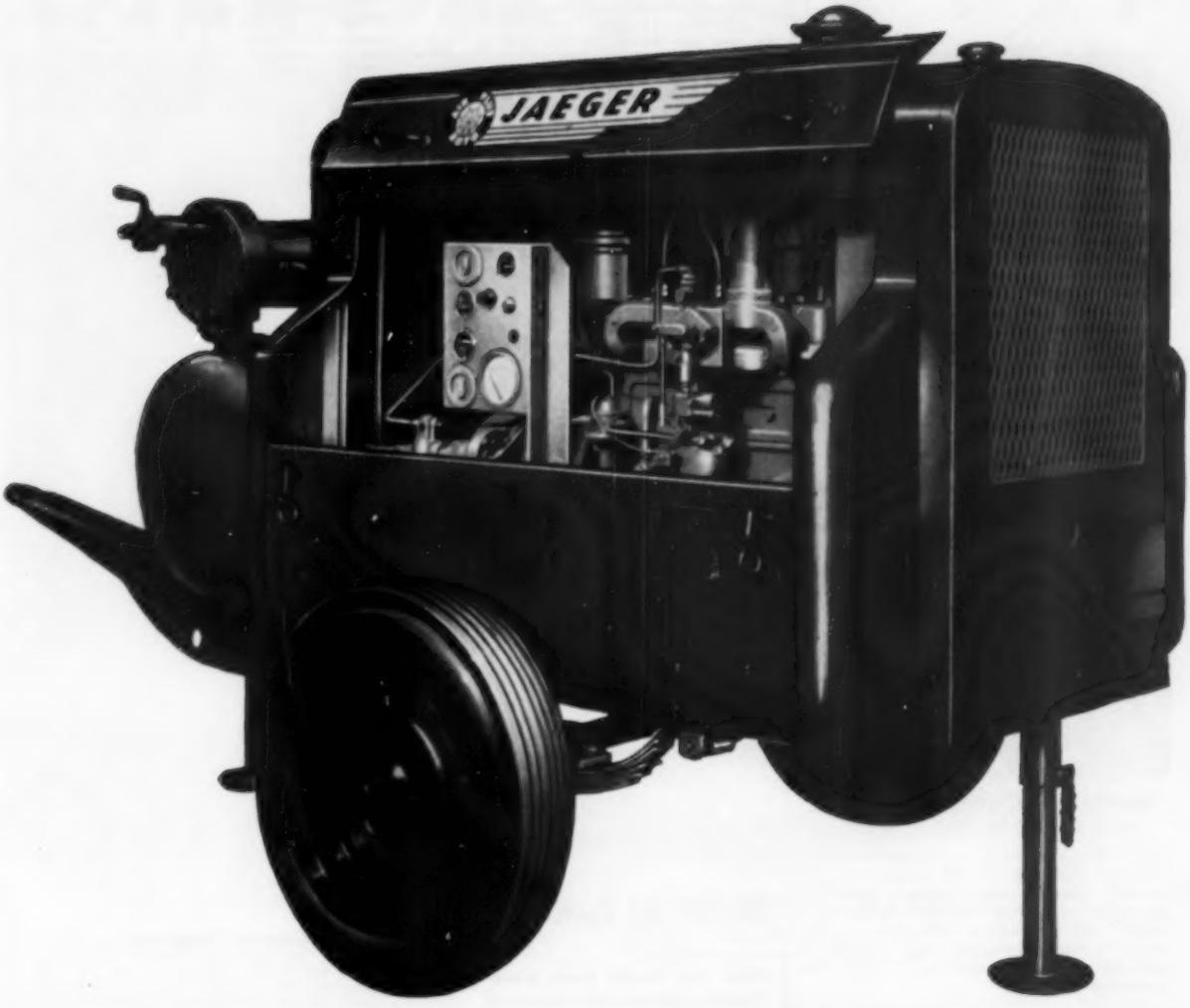

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the ideal compressor for "one breaker" work

EASY STARTING IN ALL WEATHER because it's a rotary. No piston drag.

COSTS LESS YET RUNS SMOOTHER than the reciprocating type it replaces. Puts out cooler air, too.

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FULLY EQUIPPED with automatic blow-down valve, tool boxes big enough for full set of tools, spring-mounted truck for fast trailing.

Saves money, spares effort, speeds work. See your Jaeger distributor or send for catalog.

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AIR COMPRESSORS, 75 TO 900 CFM • PUMPS • MIXERS • TRUCK MIXERS • PAVING MACHINES

To order these helpful booklets check the reply card opposite page 36.

Cut time cost on land-clearing and maintenance work with the

RUGGEDEST CUTTER BUILT

Here's how Covington Cutters save money on heavy work:

The Covington Cutter is engineered for heavy industrial work and not only out-performs but outlasts ordinary cutters. Massive, all-welded construction, an exclusive shielded flywheel and safety clutch are features that enable a Covington to take the toughest work in stride. So powerful it chews up anything a tractor can push over!

Rides over stumps and rocks without damage or slow-down!

. . . the heavy flywheel conveys unmatched power to serrated cutting blades and is shielded to slide easily over obstacles.

For tractors and Jeeps with 3-point lift.

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Gas and Gasoline Engines Described in Literature

335. Roiline engines (formerly LeRoi), gas and gasoline models are built as bare engines, complete power units, and with components and accessories for special services. Check the reply card or write Waukesha Motor Co., Waukesha, Wisc., for details on the use of these engines in compressor, generator and pumping installations.

Turn Your Water Meter Reading Inside-Out

671. The Visi-Meter is a remote recording and indicator system that eliminates the need of entering the home to read water meters. It records within an accuracy of 0.1 percent. Check the reply card or write Visi-Meter, Inc., 301 North 17th St., Kansas City, Kans., for literature.

Electronic Locators for Water Mains, Services, Valves and Boxes

677. Miniaturized line locator that is encased in a molded glass fibre container and has transistors that have a rated life of 70,000 hours and weighs only four lbs. when completely assembled is described in literature from Wilkinson Products Co., 3067 Chevy Chase Drive, Pasadena 3, Calif. Check the reply card.

Bulletin Covers Step-by-Step Action on the Water Problem

689. A step-by-step outline of action telling how the responsible citizens can help their officials extend and improve the local water system through more adequate rate structures on financing is covered in this bulletin available from Thos. F. Wolfe, Managing Director, Cast Iron Pipe Research Association, 3440 Prudential Plaza, Chicago 1, Illinois.

Mueller Drilling, Tapping and Inserting Machine

696. The Mueller B-100 double pressure chamber tapping machine makes faster taps, assures pressure tight connections and can be used by hand or with power. Check the reply card or write Mueller Co., Decatur, Ill.

●

SEWERAGE AND WASTE TREATMENT

What You Should Know About Trickling Filter Underdrains

30. Specifications for vitrified clay under drain blocks conforming to ASTM standards, suggestions for layouts and construction of trickling filter floors, dimensions of standard blocks, channel covers, angles and other fittings are available from the Trickling Filter Floor Institute c/o Editor, Public Works, 200 So. Broad St., Ridgewood, N. J. Check the reply card and we will forward your request.

How to Make Better Sewer Pipe Joints

37. How to make a better sewer pipe joint of cement—tight, minimizing root intrusion, better alignment of joint. Permits making joints in water-bearing trenches. General instructions issued by L. A. Weston Co., Dept. P.W., Adams, Mass. Check the reply card.

To Avoid Paint and Coatings Errors

50. First consult "A Catechism on Categories of Corrosion," a pocket sized brochure that enables you to share the expert knowledge of Hercules Powder Co., Cellulose Products Dept., Wilmington 99, Del. Finding out is free; not knowing could be costly.

Catalog on Synchronous Motors and Controls

64. A 27-page Catalog B-7292 on synchronous motors and controls is well illustrated and contains motor selector charts, application data, and formulas for calculating power factor. For a copy write Westinghouse Electric Corp., Box 2099, Pittsburgh 30, Pa., or check the reply card.

Theory of Controlled Digestion With Floating Cover Tanks

88. In an excellent 40-page booklet, an authoritative discussion of digestion theory and practices, including design, operation and economics is presented by the Pacific Flush Tank Co., Chicago 13, Ill. Complete data are given on the use of floating covers, together with details on tank construction, piping and control chambers.

Manual on Instrument Accessories and Supplies

96. The 60-page loose-leaf book, Catalog 500, includes specifications, part numbers and prices for more than 250 commonly furnished instrument parts and supplies. It is divided into 3 sections: Mechanical; pneumatic; electric-electronic, general, and tools and service. Check the reply card or write The Foxboro Co., Foxboro, Mass., for your copy.

Protective Lining for Concrete Pipe and Structures

131. T-Lock Amer-Plate is a tough, long-lasting acid-resistant vinyl sheet lining for concrete pipe and structures which are exposed to corrosive materials. T-shaped ribs pressed in the sheet are embedded in the concrete as it is poured to lock the lining permanently in place. Get full details from Amercoat Corp., South Gate, Calif., or check the reply card for illustrated folder.

Sewer Design Flow Chart Based on Manning Formula

154. A large-scale, convenient flow chart based on the Manning formula, together with typical examples of use, is available from Johns-Manville, 22 East 40th St., New York 16, N. Y. To get your copy check the reply card or write to the manufacturer and ask for Bulletin TR-94A.

A Short Course In Pipe Jointing

169. The story of rubber couplings for clay and concrete pipelines is graphically presented in the booklet "Pipe Enterprise", published by Hamilton Kent Mfg. Co., Kent, Ohio. Detailed description of pipe jointing methods; photos showing jobs where Tylox gaskets met the need for easily assembled permanently tight joints installed under all conditions; and a report on the development, manufacture and outstanding features of the compression type gasket make this booklet valuable to every engineer and contractor. Check the reply card.

Bulletin on Waste Treatment Equipment

289. Equipment covered in Bulletin No. 315-11 includes bar screens, grinders, collectors, skimmers, separators and flocculation equipment. Check the reply card or write Chain Belt Co., Milwaukee 1, Wisc., for this data.

Amvit Mechanical Jointed Clay Pipe

298. The new Amvit jointed vitrified clay pipe in sizes 4 through 24 inches with the true "built in" mechanical joint ready for immediate and easy installation is infiltration and root-proof. Offers better flow and less maintenance and permits deflection and absorbs shocks. It is furnished on all standard fittings and permits immediate backfilling and testing. For literature write to American Vitrified Products Co., National City Bank Building, Cleveland, Ohio, or check the reply card.

Gravity Sewer Pipe Engineering Classifications

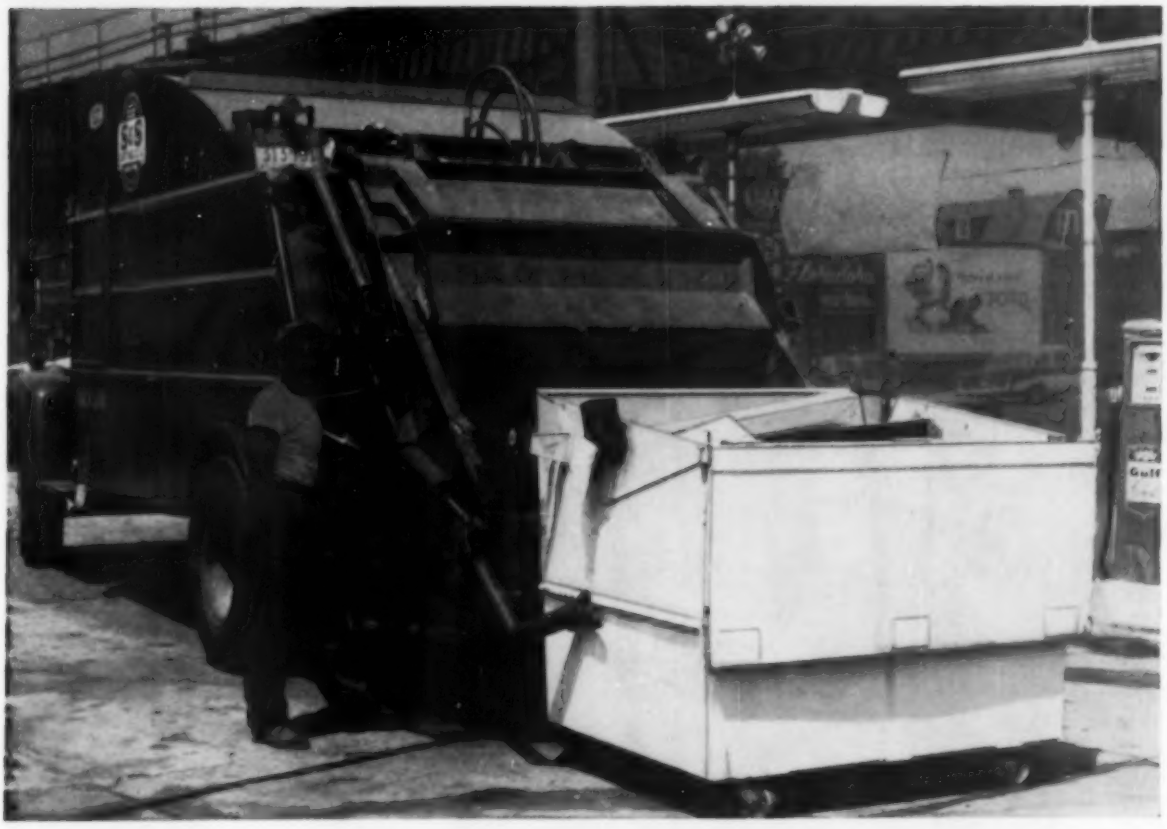
305. A quick method for choosing the most economical class of asbestos-cement sewer pipe to suit each laying condition with handy crushing table based on the Marston formula is available from Keasbey & Mattison Co., Ambler, Penna. Check the reply card.

Pneumatic Sewage Ejector Pumping Systems for Low Flows

317. Dimension and capacity tables for pneumatic float or electrode controlled ejectors, cast iron or welded steel, covering flow ranges of 20 to 600 gpm, including all information necessary in design are given in Bulletin No. KSM-2 3/58. Check the reply card or write Komline-Sanderson Engineering Corp., 101 Holland Avenue, Peapack, N. J.

(More listings on page 45)

DAYBROOK . . .



"NO OTHER UNIT WILL PACK A LOAD LIKE A DAYBROOK —*EVERYTHING* IS CRUSHED"

Dominic Salzano & Dominic Scalera
S & S Carting Company, New York City

S & S Carting Company, one of the leading and oldest private collection companies in greater New York City, now uses both the Daybrook Power Packer and Daybrook Sani-Tainer system including several of the new big 3 cubic yard containers. Here's what owners Dominic Salzano and Dominic Scalera say about Daybrook's operation:

"We operate all kinds of refuse trucks but no other unit will pack a load like a Daybrook. *Everything* is crushed. The Daybrook doesn't make as much noise as other packers and the auxiliary engine cuts down on gas consumption . . . and we've had a lot less maintenance on the Daybrook Packer than on our other units."

Daybrook's continuous loading results in faster collections. Precrushing of refuse *before it enters the body gives you bigger loads.* These and other outstanding Daybrook features insure safer operation, lower downtime and maintenance. See your local Daybrook distributor today for a demonstration. He'll be glad to show you how Daybrook can increase your profits.

Daybrook—manufacturer of a full line of truck equipment for cities, counties, state and federal governments—

Aluminum and Steel
- **DUMP BODIES**

Underbody and Telescopic
- **HYDRAULIC HOISTS**
- **POWER GATE®** *(hydraulic end gate)*
- **POWER LOADER** *(hydraulic crane for trucks)*
- **POWER PACKER** *(refuse collection body)*

Write for free literature

YOUNG SPRING & WIRE CORPORATION

DAYBROOK HYDRAULIC DIVISION
BOWLING GREEN · OHIO

Announcing a New

FERRIC SULFATE PLANT

These new facilities now in operation at Copperhill, Tennessee substantially increase our production of Ferri-Floc and will permit us to supply the increased demands for this superior coagulant at all times.

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TC
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THE COAGULANT WITH THE PLUS FEATURES

Excellent Taste and Odor Control	*Turbidity Removal*
Increased Filter runs	*Manganese and Silical Removal*
Coagulation over Wide pH range	*Bacteria Removal*
Rapid Floc Formation	*Ease of Operation*

Efficient and Economical

AVAILABLE IN BULK, AND ALSO IN DOUBLE LINED POLYETHYLENE BAGS AT NO EXTRA COST.

FREE BOOKLET — We will send you, without charge, a 38 page booklet that deals specifically with all phases of coagulation —Just make request on your firm's letterhead.

TC TENNESSEE CORPORATION
TENNESSEE CORPORATION
TENNESSEE CORPORATION
615-629 Grant Building, Atlanta 3, Georgia

To order these helpful booklets check the reply card opposite page 36.

Trenchers for Water and Sewer Line Construction

384. Three Cleveland J trenchers incorporating major advances in trencher design and operating advantages are described in Bulletin L-104 available from The Cleveland Trencher Co., 20100 St. Clair Ave., Cleveland 17, Ohio. Check the reply card for digging capacities, specifications and dimensions.

Getting Improved Sludge Dewatering With Non-Clogging Vacuum Filters

425. Latest information on the Komline-Sanderson "Coilfilter," which features non-clogging, permanent filter media to obtain constant output and low operating cost is presented in illustrated Bulletin No. 106 by the Komline-Sanderson Engineering Corp., Peapack, N. J. Be sure to investigate this improved method of sludge dewatering. Check the reply card today.

End Sewage Pumping Unhappiness

480. This new folder shows how others have done it, and why. It can be your road-map to satisfaction through "High and Dry" self-priming sewage pumps. Address The Gorman-Rupp Co., Mansfield, Ohio, or circle our card.

Complete Treatment Unit for Handling Flows to 0.5 MGD

503. Developed for sewage flow characteristics of small communities, the Aerator-Clarifier is a complete treatment unit utilizing automatic balance of activated sludge solids with sewage flow. Bulletin 129, issued by the Chicago Pump Co., 622 Diversey Parkway, Chicago 14, Ill., describes application of this unit. Check the reply card.

4-D Wrought Iron for Building Drainage Systems

551. A comprehensive 64-page catalog on piping for soil, waste, vent and downspout applications is available from A. M. Byers Co., P. O. Box 1076, Pittsburgh 30, Pa. Check the reply card for corrosive conditions, typical installation, performance tables and piping economy.

Clean Sewers Cost Less Than New Ones

554. Here is news on 1960-models sewer-cleaning equipment that can keep money in your municipal pocket. To get latest literature on the O'Brien line just write O'Brien Manufacturing Corp., 5632 Northwest Highway, Chicago 46, or check the card.

Equipment For Sewage Disposal Plants

585. Sewage gas meters, gas regulators, lubricated plug valves and water meters are described in Bulletin C-5200-3, available from Rockwell Mfg. Co., Meter and Valve Div., 400 N. Lexington Ave., Pittsburgh 8, Pa. Check the reply card.

Sewer Cleaning Service By National Power Rodding

601. N.P.R.C. has mobile-mounted equipment and trained personnel ready at all times for routine sewer cleaning jobs or specialized service. Write National Power Rodding Corp., 1000 South Western Ave., Chicago 12, Ill., or check the reply card for services available from this company.

Reinforced Concrete Pipe For Culverts and Sewers

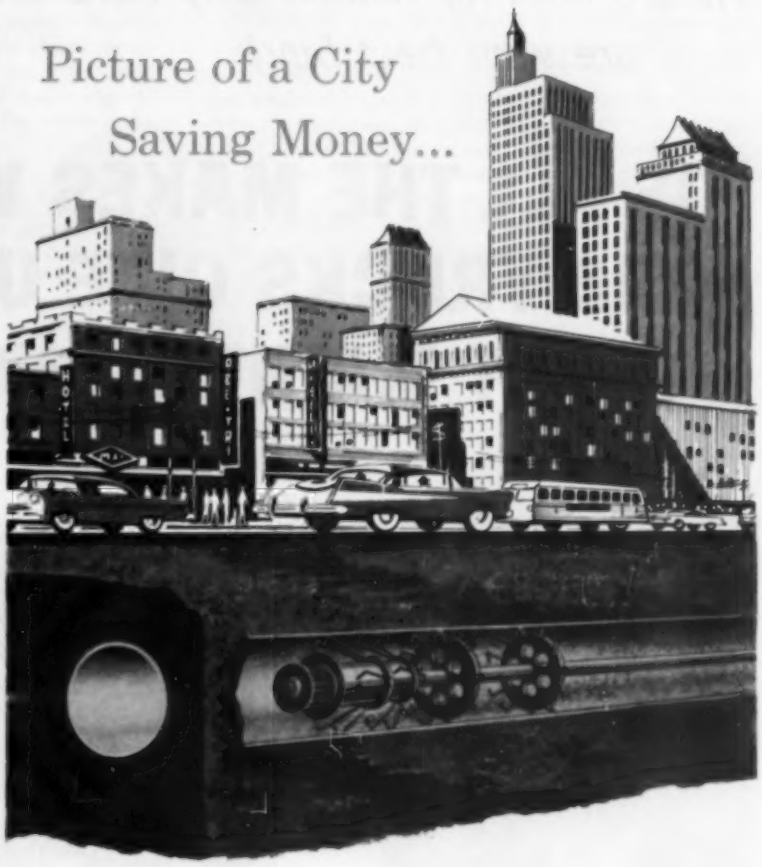
672. Elliptical Lo-Hed and Hi-Hed pipes, round pipe and flat base pipe are described fully in literature from American-Marietta Co., Concrete Products Div., 101 East Ontario St., Chicago 11, Ill. Headwall details, discharge curves, hydraulic capacity tables and hydraulic properties are included. Check the reply card.

Full Line of Sewer Cleaning Equipment

681. Everything for rodding sewers from hand operated equipment to the fully mechanized SeweRodeR. Tools for all types of stoppages are operated by Flexicrome Steel Sewer Rods. Featuring the Truck-Loder which dumps sewer deposits directly into truck, a complete range of Bucket Machines is offered. All equipment is described in 48-page Catalog 55-A. Flexible, Inc., 3786 Durango Ave., Los Angeles 34, Calif.

(More listings on page 48)

Picture of a City Saving Money...



Spunline Relines Pipe Lines in-place without removing the pipe

Another city such as Spokane, Dallas, or Los Angeles will soon be enjoying the savings of another rehabilitated pipe line. The flow will increase, the pumping cost will drop and the pipe line will be good as new for at least another quarter of a century.

And traffic will move without interruption or inconvenience to the public.

Spunline® is applicable to pipe lines down to 4" and may be used in cast iron, steel, concrete and wrought iron pipe lines.

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Subsidiary of American Pipe and Construction Co.

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P.O. Box 457 • Phones: SPruce 5-3273 — TErminal 5-8201
Rail Address, Pacific Electric, Watson, California

Here's another reason why Ford Trucks are your best buy!

"OF ALL THE MAKES WE'VE TRIED FORD TRUCKS GIVE US THE LOWEST MAINTENANCE COST!"

ANOTHER REPEAT BUYER OF FORD TRUCKS

Virgil E. Cook, owner of Cook Block and Brick Co., is convincing proof that there is still plenty of opportunity in American business for those sound planning, hard working individuals who want to own their own business. Starting from scratch just 13 years ago, he now owns and operates one of the largest concrete products plants in Eastern Indiana. The workhorses in his fleet of 16 trucks are three Ford Tilt Cab Tandems that are used to haul sand and gravel to the plant and make deliveries in and around Anderson.

Hard-working Ford CT-950 tractor leaves Cook gravel pit with 18 yards of aggregate. Aluminum walking beam and rubber suspension system of tandem axle assembly reduce chassis weight, permit higher legal payloads.

Cook's CT-850 with special flat-bed body and Side-O-Matic unloader delivers blocks right to the job site. Unit carries 600 concrete blocks and spots them where needed.

"Our experience has proved that Ford Trucks can be operated at substantially lower maintenance costs than any other make we've tried. And, equally important in a fleet like ours, we find that our Fords spend much less time in the shop. None of the Ford units purchased since 1958 have been in for major repairs and I am still amazed at the way the older ones keep going.

"The best truck we've ever owned is a 1954 Ford C-700 that consistently carries a load of 350 to 400 blocks over all types of terrain. In spite of this severe work it ran 125,000 miles before we replaced the engine. This unit now has over 140,000 miles on the original ring gear and pinion and it went 60,000 miles before we relined the brakes and put in a new clutch. This is outstanding mileage when you consider that we've realized as little as 12,000 miles from competitive ring gear and pinion sets. Clutch and brake life obtained with other makes in identical service was only 20,000 miles. It's results like this that keep our costs low and convinced us that we should stay with Fords when we bought our bigger trucks in '58.

"Our 1958 and 1959 Ford Tilt Cab Tandems give every indication of equalling or surpassing the fine records set by the C-700. The two CT-950 tractors hauling sand and aggregates to our processing plant breeze through traffic and take the hills like they weren't there at all. Our CT-850 equipped with a flat-bed body has the power and traction to deliver finished products anywhere. With Ford's tilt-cab design we get a real plus as far as payload is concerned because we can carry at least 2,000 pounds more weight on the front axle.

"We buy Ford Tilt Cab Trucks because we think they're the best engineered and most modern gasoline trucks in the heavy-duty field. Here at last is a truck built to permit big legal payloads with enough power to move these loads at economical speeds. We pride ourselves on our modern and efficient equipment and consider our Fords one of the most valuable assets of our business."

'60 Fords are built for longer life . . . with Certified Durability!

Whatever your job . . . wherever you do it . . . you'll discover just as Mr. Cook did, that Ford Trucks are the best investment for your transportation dollar.

Certified results of tests conducted by Americ 's leading independent research organization (name available on request) confirm the fact that Ford Super Duties have been refined for still more durability! Automatic radiator shutters, improved electric fuel pumps and redesigned wiring harnesses are typical of the advancements to be found in these units.

Automatic radiator shutters reduced the coolant temperature variation recorded in severe mountain road tests from a 79° range to a 20° range. Engine operation with coolant temperatures in the 167° to 187° range means less expansion and contraction, more efficient combustion and better lubrication . . . all of which contribute to longer engine life.

Dynamometer tests showed *no vapor lock* with Ford's submerged-type electric fuel pump at temperatures up to 200°. Incipient vapor lock with mechanical fuel pump resulted in a power loss of 9% under the same conditions. Shaker table tests plus constant exposure to oil, water and heat proved 1960 wiring harness to be *three times longer lived.*

FORD TRUCKS COST LESS

LESS TO OWN . . . LESS TO RUN . . . BUILT TO LAST LONGER, TOO!

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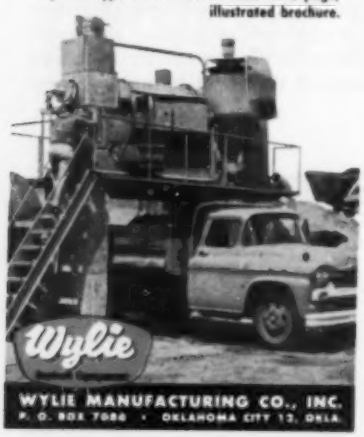
SAVE LABOR
with
ROADMASTER
Hot Asphalt Plant
It's Completely Automatic

The only self-contained asphalt plant, with fully automatic aggregate batching and asphalt metering, specifically designed for municipalities. Available as stationary or mobile unit. Costs no more than manually operated plants. SAVES THE LABOR OF AT LEAST ONE MAN. Rotary dryer with forced draft. Twin-shaft pugmill with enclosed oil-bath gear box. Enclosed bucket elevator and reciprocating feeder. 400 gallon asphalt tank. Cyclone-type dust collector. Send for 8 page, illustrated brochure.



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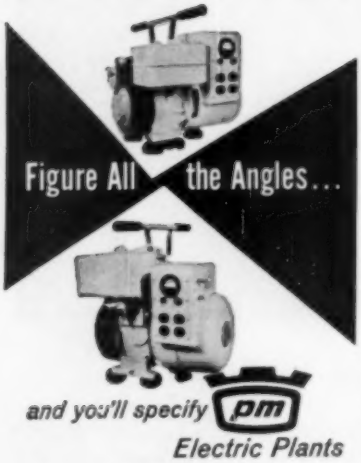

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North Hollywood 9, Calif.
Manufacturers of the Thomas Electronic Organ

STREETS AND HIGHWAYS

Bitumuls Paving Handbook Full of Useful Data

23. The latest edition of the Bitumuls Paving Handbook covers a wealth of practical data on paving methods and materials, road and airport paving specifications and construction details, complete tabular data on asphaltic binder applications and aggregate requirements, condensed Asphalt Institute specifications plus data on Laykold compounded asphalts for flooring, tennis courts, protective coatings and waterproofing. You can have a copy by checking the reply card. American Bitumuls & Asphalt Co., 320 Market St., San Francisco 20, Calif.

Roll Your Own (Roads) With Gallons

101. New 12-ton, 9-wheel pneumatic-tire roller illustrated, diagrammed and explained. For a quick picture of this efficient new model ask for Bulletin No. 434 from the Galion Iron Works & Mfg. Co., Galion, Ohio.

How Accurate Boring Speeds Underground Pipe Installations

135. Interesting charts showing earth boring costs, speed and accuracy for holes from 2½" to 14½" diameter and up to 80 feet long are included in 16-page Catalog No. 8 issued by Hydrauger Corp., 681 Market St., San Francisco 5, Calif. Specifications and general operating instructions are also covered.

Davis Backhoe Has Hydra-Slide Positioning

189. It is possible for one man to move the entire digging assembly along the frame to any of the five positions in less than five minutes. Full details from Massey-Ferguson Industrial Div., 1009 South West St., Wichita, Kans. Check the reply card.

Traffic Protection with AmBridge Highway Beam Guard Rail and Posts

205. USS AmBridge beam guard rail can be furnished in 25-ft. lengths and with the steel posts make a strong, highly visible and economical guard rail. Check the reply card or write American Bridge, Division of United States Steel, Pittsburgh, Pa.

Illustrated Specifications on Brush and Limb Disposal

222. A new booklet on the modern approach to the brush problem shows how an Asplundh chipper reduces bulky branches and brush trimmings to chip size for mulch or easy removal. Write Asplundh Chipper Company, 501 York Road, Jenkintown, Pa., or use the handy reply card.

Portable Hot Asphalt Paving Repair Unit

250. Maximum economy in paving repair and maintenance is claimed for the compact "Patchmobile" which has a rotary tube continuous dryer, batching hopper for accurate proportioning, twin hot asphalt tanks, heat jacketed pugmill, tool heaters and hand spray bar. Get latest data from Wylie Mfg. Co., 5926 N. W. 39th St., Oklahoma City 12, Okla. Use the reply card.

How to Solve the Brush Disposal Problem

277. Fitchburg Chippers, engineered to solve the brush disposal problem reduce troublesome brush and trimmings to tiny, easy-to-dispose-of chips. Several models are available to meet your needs. May be mounted on truck body or on trailer, tractor or jeep. Full details in interesting, profusely illustrated 16 page bulletin. Write Fitchburg Engineering Corp., Fitchburg, Mass.

Patch Paving in the Morning, Let Traffic Roll in the Afternoon

419. That's the startling story of what Epoxy Patching can do. For case history and procedures get SIKA FLASH 170 bulletin. Address Sika Chemical Co., 35 Gregory Ave., Passaic, N. J., or check our card.

Slurry-Seal Spreader For Surface Sealing

370. The new slurry-seal method with the Tarco spreader gives a thin, even application of asphalt-sand-water slurry and fills and seals cracks and makes skid-proof surfaces. Check the reply card or write Tarrant Mfg. Co., 28 Jumel Place, Saratoga Springs, N. Y., for complete details.

The Trucks You Need for Every Public Works Job

461. Extra life and operating economies are built-in features of every Ford truck model. There's a chassis size and engine for each of your needs, from light utility work to heavy-duty construction jobs. Get latest literature from Ford Motor Co., Truck Div., Dearborn, Mich., by checking the reply card.

Levels Sidewalks and Curbs Quickly and Easily

510. How the Mud-Jack Method for raising concrete curb, gutter, walks and streets solves problems of that kind quickly and economically without the usual cost of time-consuming reconstruction activities—a bulletin by Koehring Company, 3026 W. Concordia Ave., Milwaukee 16, Wis. Check the reply card.

Tired of Juggling a Bubble?

546. Surveyors will like the relief offered in a new booklet, The Zeiss Level Casebook, which is chock full of fascinating case histories as well as telling how to halve your job time, on an average. Just write Keuffel & Esser Co., Hoboken, N. J., or circle our card.

Complete Line of Asphalt Patching Mixers

586. Mixers capable of mixing 3 to 20 tons of hot mix per hour are described in literature available from McConnaughay Mixers, Inc., Lafayette, Ind. Check the reply card for full information on patching, repairing, resurfacing and sealing.

Use The Reply Card

Construction Methods for Salt Stabilized Roads

609. A comprehensive booklet showing modern methods of salt stabilization is available from the Morton Salt Co., 110 Nr. Wacker Drive., Chicago 6, Ill. Stabilized secondary roads, base courses and shoulders are discussed and all equipment and construction methods are covered. Just check the reply card for your copy.

Basic Fundamentals of High-Speed Earthmoving Techniques

617. This bulletin illustrates and explains the major factors in earthmoving equipment selection. Check the reply card or write the Advertising Division of Caterpillar Tractor Co., Peoria, Ill., for charts and performance characteristics.

Better Roads With Sterling Rock Salt

650. This manual describes the simplified 7-step method of road improvement with rock salt. This type of salt stabilization is designed for cities, townships and counties. Check the reply card or write Highway Sales Dept., International Salt Co., Clarks Summit, Pa., today.

Manual on Highway Railings For Bridges and Roadways

660. This manual covers design suggestions, components, specifications for design and construction and the advantages of Alcoa aluminum alloy highway railings. Check the reply card or write Aluminum Company of America, Alcoa Bldg., Pittsburgh 19, Pa., for this valuable manual.

Sweepers Handle A Variety of Jobs In Every Season

684. Mechanical drive one-way and pull type 2-way sweepers and hydraulic 2-way sweepers that are tractor-mounted or loader-mounted are fully covered in literature from M-B Corp., 1611 Wisconsin Ave., New Holstein, Wisc. Jobs like cleaning dust, dirt and snow from streets and highways and sweeping park lawns are a few of the sweepers applications. Check the reply card.

IN LANDSCAPING, LOADING, CLEAN-UP, STOCKPILING, AND DITCHING AT LOWEST POSSIBLE COST

the MASSEY-FERGUSON 204
SPEAKS FOR ITSELF:

"I HAVE DONE... CAN DO!"

Approved wherever it's used . . . profitable on *any* job site . . . the only one in its class . . . that's the Massey-Ferguson 204 Industrial Tractor! This high-torque, 40-h. p. tractor moves in and out of crowded areas with the agility of a kitten. Exclusive M-F *"Instant Reverse"* lets you change directions of travel at a touch of a foot pedal, without shifting or clutching. The famous Massey-Ferguson Loader is power fitted to make an integrated unit. There's a payoff at both ends, too, when equipped with the popular and powerful Massey-Ferguson Backhoe as illustrated, or with one of the other matched attachments such as the multi-purpose M-F Scarifier-Scraper. Think of the jobs you can do, and of the ease with which they're done. The 204 does it for others, it can do it for you. A demonstration will prove it!

Featuring INSTANT REVERSE with TORQUE CONVERTER

Go Forward or Back . . . at a Touch of your Toe!
NO SHIFTING · NO CLUTCHING · NO LEVERS TO PULL

Why Wait? — Set a Date — We'll Demonstrate!

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INDUSTRIAL DIVISION
Block 1000 South West St., Wichita 13, Kans.

Producing Sizeable Power for the "Sensational 60's"

To order these helpful booklets check the reply card opposite page 36.

CONSTRUCTION EQUIPMENT AND MATERIALS

Useful Attachments for "Payloader" Tractor Shovels

95. Increased versatility for Hough "Payloader" tractor shovels is made possible by the various attachments described in literature of the Frank G. Hough Co., 761 Seventh St., Libertyville, Ill. Illustrated and described are rotary "V" and trip-blade snow plows, hydraulic backhoe, back-filler blade, pickup sweeper, scarifier teeth, winches, etc.

A Fully Rotary Compressor by Jaeger

289. Complete information is available from The Jaeger Machine Co., Columbus 16, Ohio on this 2-stage, oil-cooled rotary compresser. Features include 80% fewer moving parts, up to 30% less weight, vibrationless operation and 100° cooler air.

The Principles of Compaction by Vibration

288. Compaction specifications that can't be met with ordinary compactors are no problem to the new Essick vibrating rollers. Complete descriptive literature explaining the principles of compaction by vibration and the Essick vibrating roller is available from Essick Mfg. Co., 1950 Sante Fe Ave., Los Angeles, Calif.

Power Tamper for Granular Soil and Bituminous Surfacing Work

342. The Kelley Power Tamper is a self-propelled unit that is equivalent to a 10-ton roller for backfilling, road widening jobs and compacting around culverts and pipeline trenches. For complete specifications write Kelley Machine Div., Wiesner-Rapp Co., Inc., 285 Hinman Ave., Buffalo 23, N. Y., or check the reply card.

From a Stump to Chips in Minutes

303. Pow-R-Stump cutter is operated by one man, handles stumps of any width and up to 33 ins. in height and will not damage curbs, driveways or sidewalks. For literature check the reply card or write Vermeer Mfg. Co., Pella, Ia.

3 and 4-cu. yd. Tractor Shovels With Torque Converter Drives

415. Operating, performance and maintenance advantages offered by the Allis-Chalmers HD-16G and HD-21G torque converter drive tractor shovels are described in 8-page catalog MS-1274, available from Allis-Chalmers Mfg. Co., Construction Machinery Div., Milwaukee, Wisc. Check the reply card for specifications.

Motor Graders With Torque Converter and Power Shift Transmission

430. Complete operation data and specifications of Huber-Warco motor graders are covered in Bulletin No. HWG521 available by checking the reply card or by writing Huber-Warco Co., Marion, Ohio.

Complete Bulletin On Municipal Supplies

473. Everything from leak locators to street signs is listed in the big 100 page bulletin "Municipal Supplies" published by Darley. Hundreds of different items for all city departments are included. Get your copy of Bulletin No. 155 from W. S. Darley & Co., 2814 Washington Blvd., Chicago 12, Ill.

Principles of "BatchOmatic" Plants Explained

527. The unique principles of simultaneous and fully automatic aggregate and bitumen measuring followed on Barber-Greene's 2,000, 4,000 and 6,000 lb. "BatchOmatic" bituminous batch plants are explained with cut away drawings, charts and other illustrations in a 3-color bulletin offered by Barber-Greene Co., Aurora, Ill. Check the reply card.

Electric Plants, Warning Flasher Lights and Concrete Vibrators

348. Models, specifications, accessories and other data on flasher lights, electric plants and vibrators are covered in catalog from Pacific Mercury, 13232 Leadwell, North Hollywood 9, Calif.

Manual on Construction Castings

462. This 168-page Manual covers catch basin inlets and traps, building castings, manhole covers and steps, flap valves, wheel guards, drainage grates and many other construction and maintenance castings. Check the reply card or write Neenah Foundry Co., Neenah, Wisc., for your copy.

Specification Sheets on John Deere Tractors and Equipment

588. Information and specifications on the John Deere crawler and wheel-type industrial tractors and working equipment. Deere & Co., Industrial Division, Moline, Ill. Check the reply card. State type of tractor and equipment.

Construction Guide For Engineers and Builders

669. A 34-page four sectioned construction guide containing full-page structural drawings that provide basic information on types, grades and applications of fir plywood for engineers and builders has been released by Douglas Fir Plywood Association, Tacoma 2, Wash. Check the reply card for data on floor construction, single and double wall construction and roof construction.

Slide Rule PS1 Calculator For Concrete

713. A new pocket size slide rule calculator for the testing of concrete in compression is available from Forney's Inc., P.O. Box 310, New Castle, Pa. It is designed to convert instantly the pressure applied to concrete cylinders and blocks into psi.

(More listings on page 54)

"Hardrock Smitty" says: — Get the job done

- **QUICKLY**
- **EFFICIENTLY**
- **ECONOMICALLY**

with the

SMITH 125 AIR COMPRESSOR

Rugged construction, smooth performance . . . in an Air Compressor designed to stand up under the "toughest" job conditions. The SMITH 125 operates on a 6-cylinder, instant-starting Hercules Industrial engine—using 3 cylinders for power, 3 for compression. It will satisfactorily operate two 85-pound paving breakers at the same time. Tested and proved to be the most dependable, inexpensive to operate and maintain Air Compressor available, the SMITH 125 will give years of efficient service.

Compare the price . . . compare the job results—you'll find it's profitable to "GO SMITH" with "Hardrock Smitty"

Write us for the name of your nearest dealer and for complete information about the 125 and other models, portable and stationary.

SMITH
AIR COMPRESSORS

GORDON SMITH & COMPANY, INC., Bowling Green, Ky.

Ask your dealer for an "on the job" demonstration.

FLUIDICS* AT WORK

New Simplex telemeter reads and controls 2 to 29 channels

The new Orthoplex telemetering system uses a biplex generator and biplex selector to achieve dual signal telemetering using a single pair of telephone lines.

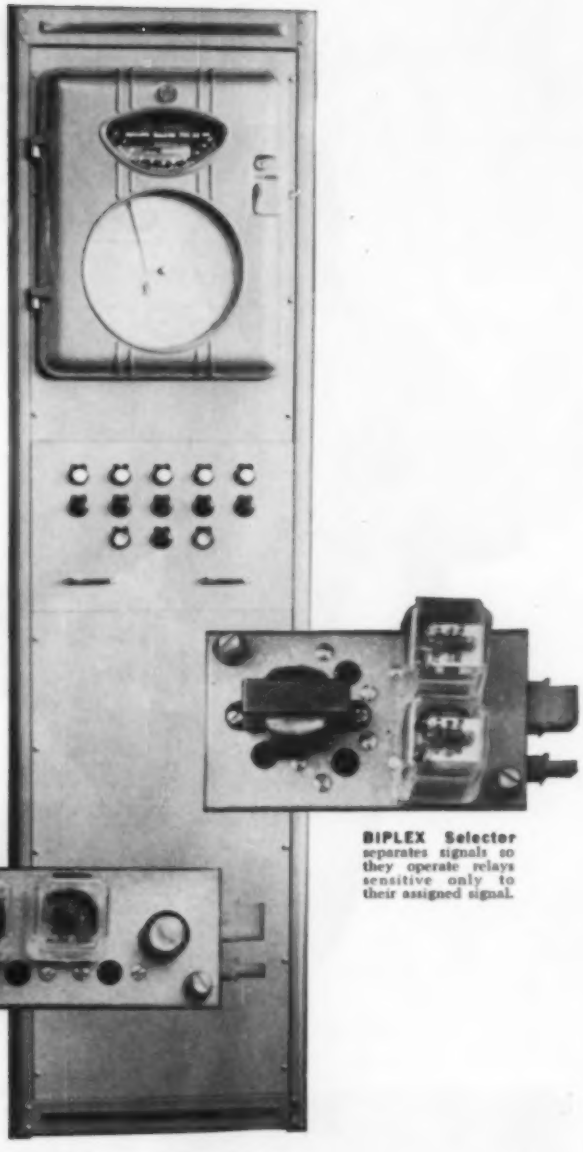
In the basic system the generator produces both a dc and a 60-cycle ac signal which is unscrambled at the receiving end by the selector. These 2 signals are fed into a multiplexing unit which provides the extra channels.

Uses ac and dc signals—Combining ac and dc currents produces a circuit less affected by line capacitance and able to give a longer distance transmission with available capacitance.

The new system requires much less maintenance than previous designs. It uses no vacuum tubes, eliminates all motorized timers and motorized sequence switches; and the modular units are equipped with "quick-disconnect" connectors, plug-in relays, and rectifiers of advanced design.

Modular design—The modular design allows building up as many as 29 separate channels for supervisory indicators, alarms, telemeter receivers, pump controls, valve positioners, etc.

For complete specifications and design theory, write for bulletin to our Simplex Division, Dept. PW-10, Lancaster, Pa.



BIPLEX Selector separates signals so they operate relays sensitive only to their assigned signal.

BIPLEX Generator is designed to give two signals, a positive dc and 60-cycle ac.

SIMPLEX Orthoplex Supervisory Control provides you with a system for remote control of valves and pumps from a central station.

*FLUIDICS is a new Pfaudler Permutit program which provides a modern, imaginative approach for handling and processing liquids and gases more profitably.

SIMPLEX®
VALVE AND METER COMPANY
a division of PFAUDLER PERMUTIT INC.
Lancaster, Pennsylvania
Specialists in FLUIDICS . . .
the science of fluid processes

"Look...the
Steering Levers
are Gone!"

now you STEER, STOP, and REVERSE
with the NEW JOHN DEERE

PILOT touch

the only Single Stick crawler control

Ease the stick forward, back, left or right—the way you want to go—and the John Deere Crawler obeys! Clutching is automatic—braking, too—so no footwork is required.

One-hand driving with hydraulic-powered Pilot-Touch keeps the operator fresh and alert—frees a hand for full-time control of loader, dozer, or other equipment. Payoff—a better job, and higher daily work production.

Pilot-Touch is an exclusive John Deere development, yours optionally on both Diesel and gasoline "440" crawlers. Your nearby John Deere Industrial Dealer soon will be demonstrating crawlers with this new hydraulic-powered control. See him or write us for complete details.

John Deere Industrial Division, Dept. 2045, Moline, Ill.

JOHN DEERE *"Specialists in Low-Cost Power with a Heavyweight Punch"*

To order these helpful booklets check the reply card opposite page 36.

Superior Design, Construction and PERFORMANCE
far greater strength and SAFETY!
AMERICAN
Approved
PLAYGROUND AND SWIMMING POOL EQUIPMENT
The wise choice of experienced buyers for nearly half a century.
WRITE FOR LITERATURE
AMERICAN
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ANDERSON, INDIANA, U.S.A.
WORLD'S LARGEST MANUFACTURERS OF FINE PARK, PICNIC, PLAYGROUND, SWIMMING POOL AND DRESSING ROOM EQUIPMENT

90% cut in operating and maintenance cost means
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New, transistorized
M-SCOPE PIPE FINDER only
$189.50
Rugged, transistorized construction practically eliminates maintenance costs . . . extends battery life to a year or more. Pinpoint accuracy, greatest depth penetration make the M-scope first choice in the field!
Heavy Duty LEAK DETECTOR . $295.00
Send for FREE 1960 Catalog
FISHER
Research Laboratory, Inc.
Dept. PW-6, Palo Alto, Calif.

REFUSE COLLECTION AND DISPOSAL

Where Does It Go From Here?

63. That is the title of new 12-page booklet, D 930, with thorough discussion of garbage disposal by sanitary landfill method. Read the latest report from the experts. Caterpillar Tractor Co., Peoria, Ill., or check card.

Reduce Your Refuse Disposal Costs

150. A complete line of refuse disposal systems that include containers, giant containers, compaction bodies and compaction trailers are described in literature from Dempster Brothers, Dept. PW, Knoxville 17, Tenn. Check the reply card for data on these efficient systems.

Versatility, Compaction Force Account For Extra Packer Capacity

159. The many advantages of this modern packer unit have been combined into a factfilled bulletin entitled "The Big Squeeze" which is available from E-Z Pack Div., Hercules Galion Products, Inc., Galion, O.

Load-Packer 600 Points the Way to the Best in Refuse Collection

188. Bulletin W-200 explains how the Gar Wood Load-Packer gives faster operation, bigger payload, more compaction, a larger hopper and more dependable operation. Write Gar Wood Industries, Inc., Wayne, Mich., or check the reply card for full details.

Literature Describes M-B Contain-O-Pack System

190. A 6-page catalog describing the M-B Contain-O-Pack, a complete low cost containerized refuse system for private haulers and municipalities is available from M-B Corp., New Holstein, Wisc. Check the reply card.

Bulk Refuse Collection with Super Roto-Can

192. A bulletin describing the bulk refuse system called the City Tank Roto-Can, which provides an unusual flexibility of service and the handling of all types of trash, is available from City Tank Corp., Corona, N. Y. Check the reply card.

General Specifications for Refuse and Garbage Trailers

251. Two bulletins, one on the Pak-Mor 38 cu. yd. tandem axle trailer unit and the other on the Pak-Mor 32 cu. yd. trailer for use with Model GRD Dempster are available from Pak-Mor Manufacturing Co., Box 6147, San Antonio, Texas. General specifications, power train, operating procedures, maintenance and lubrication and other helpful information are included.

Power Packer and Sani-Tainer Refuse Collection Methods

272. A 4-page bulletin on the Power Packer refuse collection bodies and the Sani-Tainer refuse containers for municipalities is available from Daybrook Hydraulic Div., Young Spring & Wire Corp., Bowling Green, Ohio.

How to Construct A Sanitary Fill

331. A new 12-page booklet which tells the most efficient method of sanitary fill construction and furnishes complete information on planning and operation is now available from Drott Mfg. Corp., Milwaukee 15, Wis. Get your copy by checking the reply card; you'll find this booklet both interesting and valuable.

Modern Methods in Sanitary Landfills

699. Up-to-date data, pictures and explanation of sanitary landfill, its methods and equipment are covered in this valuable bulletin from The Oliver Corp., 19300 Euclid Ave., Cleveland 17, O. Check the reply card for information on satisfactory garbage and refuse disposal methods.

STREET LIGHTING AND TRAFFIC CONTROL

Steel and Aluminum Lighting Standards

34. Street and highway lighting standards, floodlighting standards, traffic signal standards and arms, strain poles, brackets and mast arms and accessories are some of the units described in catalong from Kerrigan Iron Works Company, P. O. Box 479, Nashville 2, Tenn.

Residential Street Lighting

228. A new 16-page bulletin on residential street lighting is now available from the General Electric Co., Schenectady 5, N. Y. Well illustrated, the bulletin, designated GEA-6316, explains how good lighting benefits a residential community and provides information on how to plan modern residential lighting installations.

Solve the Downtown Traffic Problem With Electronics

232. Signals are controlled by the traffic in the Electro-Matic PR system by using radar, the analog computer, electronic timing and electronic controls. Write Automatic Signal Div., Eastern Industries, Inc., Norwalk, Conn., or check the reply card.

Westinghouse Silverliners With or Without Built-In Ballast

259. For complete catalog on these mercury luminaires check the reply card or write Westinghouse Electric Corp., Lighting Div., Edgewater Park, Cleveland, O. Full details are covered on these lighting units.

Monotube Poles for Highway Lighting and Signing

432. Highway pole designs, in both steel and aluminum, as well as various overhead sign mounting arrangements are illustrated in Catalog LS-23 available from The Union Metal Mfg. Co., Canton 5, Ohio. Check the reply card for base and bracket details and other specifications.

SNOW AND ICE CONTROL

Calcium Chloride For Road Construction and Maintenance

41. Calcium chloride for concrete road construction, for maintenance of unpaved roads and for the control of ice are covered in literature from The Dow Chemical Co., Midland, Mich. Check the reply card.

Catalog on Tractor-Driven Tailgate Spreader

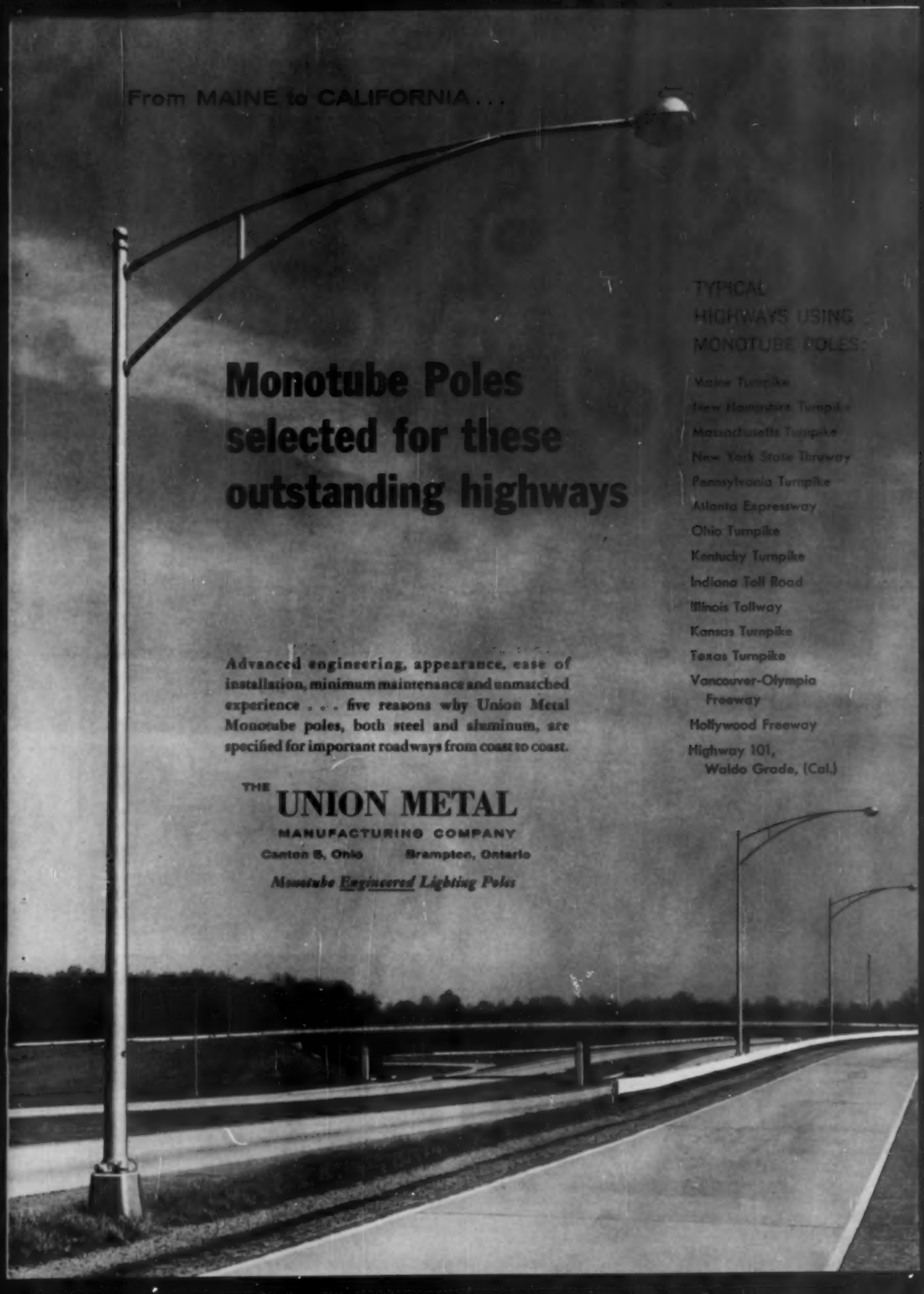
182. Highway Equipment spreader spreads in the echelon pattern for ice control and the blanket pattern for seal coating. For literature write Highway Equipment Co., Dept. H41 616D Ave. N. W., Cedar Rapids, Iowa.

Winter Road Maintenance With Calcium Chloride

386. This bulletin contains data on why calcium chloride mixtures work better, how and in what percentages to store, mixing methods and recommendations for various storm conditions. Check the reply card or write Columbia-Southern Chemical Corp., One Gateway Center, Pittsburgh 22, Pa., for your copy.

Ice Control Without Corrosion Dangers

439. Virtually all corrosion is prevented when rust inhibitor "Banox" is used in conjunction with salt for snow and ice control. Properties of this material and performance results are described in bulletins issued by Calgon, Inc., Hagan Bldg., Pittsburgh 30, Pa.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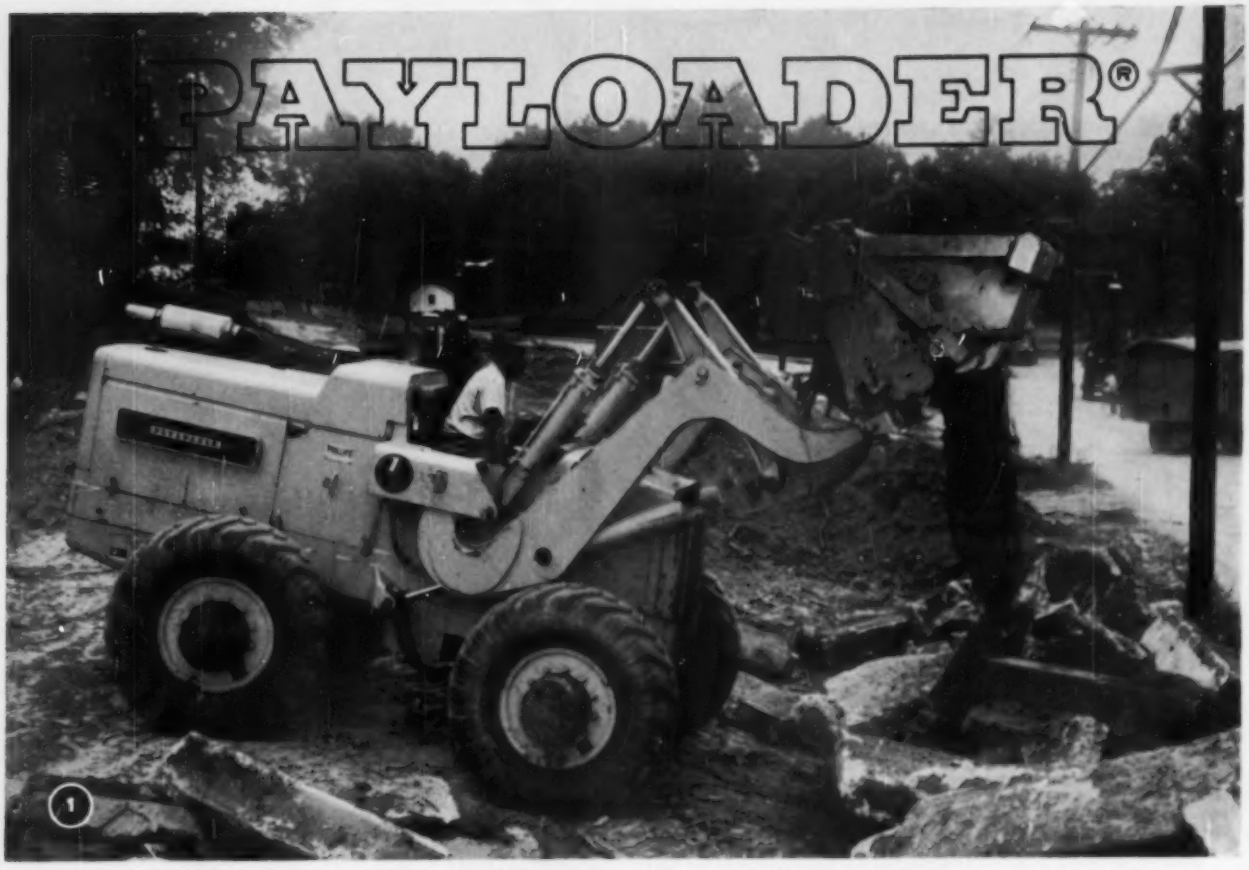
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Patented Drott bucket is a "PAYLOADER" exclusive on rubber. Does many shovel, clamshell, scraper and bulldozer jobs.

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Built exclusively for "PAYLOADER" by Wain-Roy. 190° working radius permits right angle dig and dump. Mounts front or rear.

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Forks adjust to fit varied size pallets or loose loads of lumber, sheeting, pipe, logs. Easily interchangeable with bucket.

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Another "PAYLOADER" exclusive by Ram. Individual hydraulic motors power reel and conveyors. Picks-up 90% of bulk.

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Jackson vibrators efficiently develop specified densities in all granular soils. Electric motors on each of four 30-in shoes.

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Superior-Hough hydraulic boom lifts 5-tons, telescopes 10 to 16-ft. Does not interfere with bucket use.

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Insert Rubber gasket in bell end of pipe — you can't put it in wrong — A child can do it.

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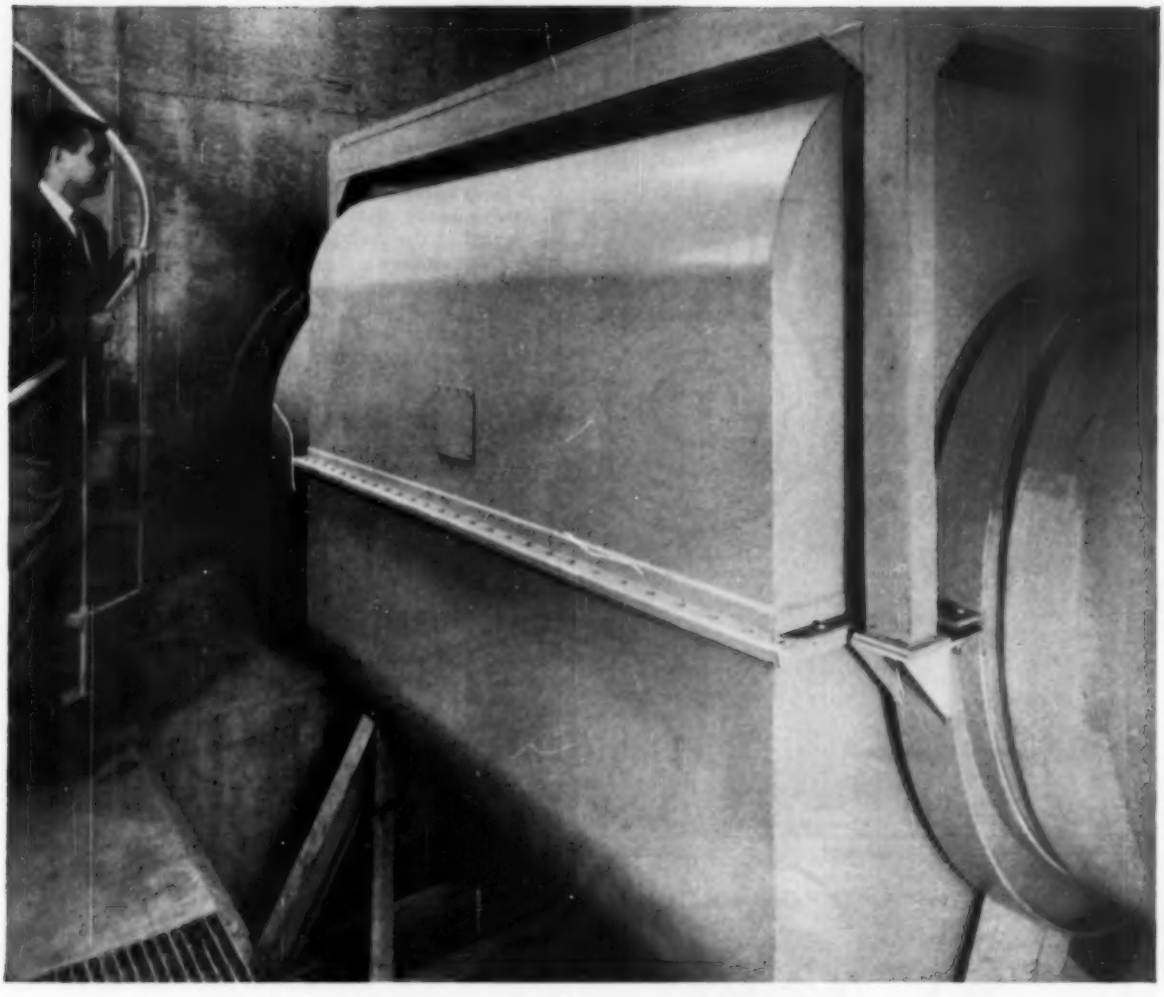
TRICKLING FILTERS and AEROBIC DIGESTION

R. S. RANKIN
Consultant, Water and Sewage Treatment

CONSIDERABLE interest has been shown during the past few years in aerobic digestion of solids in combination with treatment by the activated sludge process. This discussion questions whether aerobic digestion is necessarily limited to aeration by compressed air or is it possible to accomplish similar results using trickling filters. Biologically the activated sludge process and the trickling filter process function to produce the common objective of oxidizing the organic matter in the sewage. The major difference is in the method of obtaining the necessary oxygen from the air for support of the organisms. Generalizing, the one pumps the air into the liquid while the other pumps the liquid into the air. Power is used in the first for compressing air and circulating the organisms through the liquid while in the second power is used for circulating the liquid over organisms which are stationary and surrounded by atmospheric air. There must be a way of utilizing trickling filters for aerobic digestion which after all is one of nature's most prevalent processes. To find that way, a description of present practice is essential.

The aerobic digestion process as a means of complete treatment was apparently first recognized in Ohio in 1947 at a plant in East Palestine. Knox (1) of the State Department of Health relates how the operator of this conventional activated sludge plant was recirculating all of the sludge in the final settling tank back into the aeration tanks, wasting none and yet turning out an excellent effluent. This method of operation was next tried successfully on the treatment of milk wastes and then in several small plants for domestic sewage from laboratories, school houses, and factories. As a result of the information obtained from these and other subsequent plants the Ohio authorities obtained sufficient data to issue on January 1, 1958, a set of design factors for this type of plant. The requirements include an aeration tank of 24 hrs. capacity based on average daily flow, an air supply of either 3 cfm per ft. of aeration tank length or 2100 cu.ft. per lb. of 24-hr BOD, whichever is larger. Other requirements include a final tank with 4 hrs. detention and recirculation of



at Orange County (Calif.) Sewage Treatment Plant:

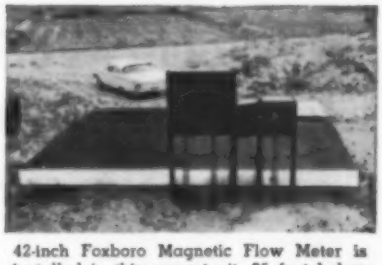
42" Foxboro Magnetic Flow Meter Handles up to 60 Million Gallons Effluent Per Day

giant meter has no flow restrictions of any type

The County Sanitation Districts of Orange County, Calif. have a total of 4 Foxboro Magnetic Flow Meters. The giant meter shown above measures effluent flow from Plant #1. Additional 16", 20" and 24" meters measure influent flows on trunk lines entering the plant.

Mr. Robert N. Galloway, Superintendent of Plants, reports that the 42" meter has required no maintenance whatever since it went on stream in the summer of 1958. The Magnetic Flow Meters, Mr. Galloway adds, not only furnish vital plant operation data, but more important, serve as the basis for apportioning costs to the various sanitation districts in Orange County contributing to the plant flows.

Measuring sewage is no problem for the Foxboro Magnetic Flow Meter. It has no orifice plates, no pressure taps, no line restrictions of any kind. There is nothing to corrode — nothing to take apart and clean. Ask your nearby Foxboro Field Engineer for full details or write for Bulletin 20-14. The Foxboro Co., 261 Norfolk Street, Foxboro, Massachusetts.



42-inch Foxboro Magnetic Flow Meter is installed in this cement pit, 25 feet below ground. Instrument at right is Foxboro Teletax Transmitter, providing instantaneous transmission of effluent flow measurements to Orange County's central operating station.

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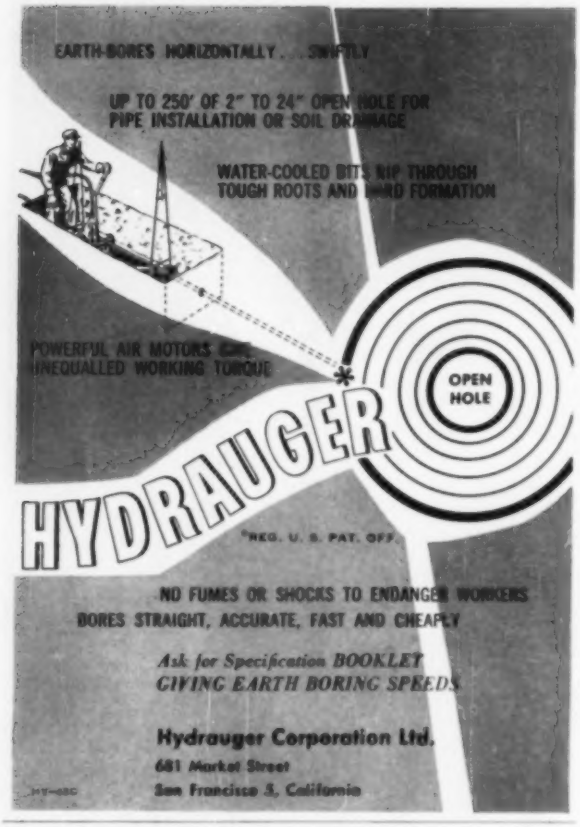
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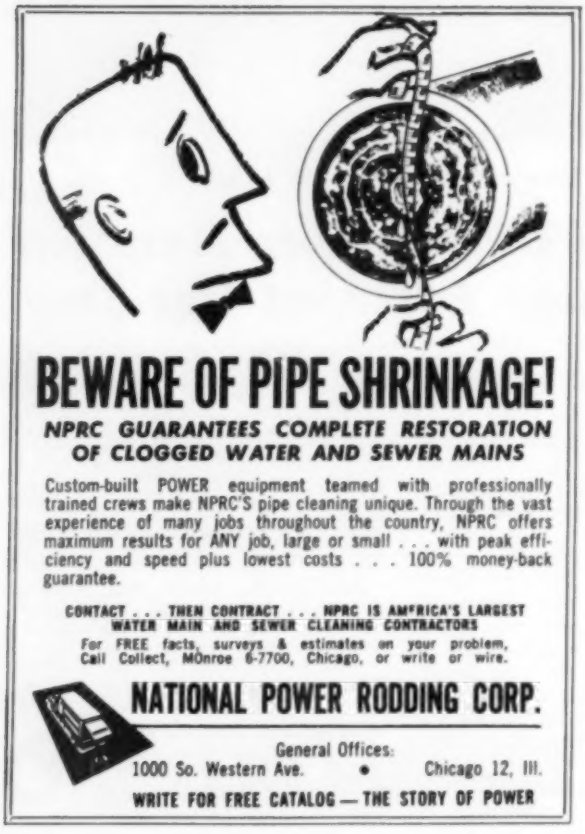
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1 to 1 based on 24-hr flow. In some cases sludge holding tanks with a capacity of 8 cu.ft. per capita are recommended although not required for plants using diffused air aeration. Primary sedimentation is not a requirement.

Although in these plants flow variations are often extreme, the effluents are of excellent quality and seldom exhibit more than minor variations. This is due probably to the high solids load, up to 9000 mg/L, carried in the aeration tanks. One significant feature is that although sludge is seldom wasted, drained tanks often show no accumulations of consequence. From the absence of grit it is apparent no surface waters enter these plants and organic matter is being reduced to an inert ash which passes into the effluent in an extremely fine or colloidal state. In Ohio alone, plans for over 260 plants of this type had been approved by late 1958.

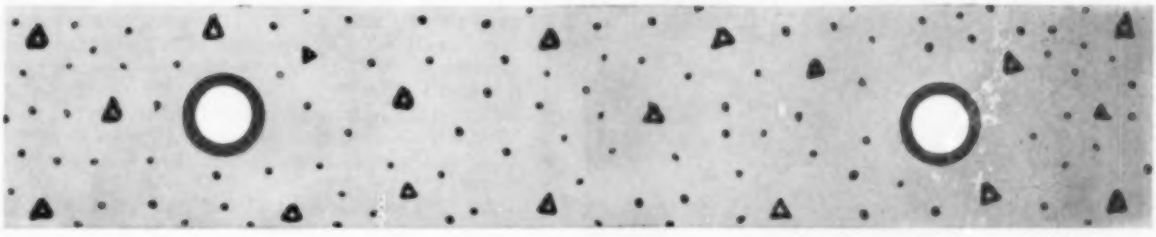
This type of plant is obviously attractive for small installations even though requirements for tank capacities are over twice those for conventional treatment. For this reason there is an upper economical limit to the size of plant. Biologically, however, there is no apparent reason for limiting the size. While aerobic digestion appears to be a new way of extending the application of the activated sludge process Hammond (2) of Brooklyn, as long ago as 1916, proposed prolonged aeration as a means of reducing waste activated sludge to 10 percent of its initial volume. However, his proposal appears to have been ignored and the waste sludge problem still plagues large plants even today.

As to the possible application of trickling filters to aerobic digestion some interesting comparisons can be made. The Ohio rules, as stated, require 2100 cu. ft. of air be supplied per pound of BOD entering the aeration tank daily, or about twice conventional requirements. Assuming the air weighs .075 lb./cu.ft. and contains 23 percent oxygen by weight, then the 2100 cu.ft. are equivalent to 36 lbs. of oxygen per lb. of BOD per day or a theoretical efficiency of utilization of 2.8 percent. Some air obviously escapes and some probably represents an excess as a factor of safety. Required detention in the aeration tank on the basis of 100 gallons and 0.17 lb. of BOD per capita per day is the equivalent of 12.8 lbs. BOD per 1000 cf which compares with 30-35 lbs. in conventional plants.

Nelson (3) discusses spiral contact aeration in a number of plants in which the sewage is passed over a shallow trickling filter at extremely high rates and then flows into a contact tank of several hours capacity. Careful analysis of performance at one plant proved that each recirculation over the filter picks up an average of 4 mg/L of oxygen and that this accounted for 54 percent of the oxygen used in the treatment. The difference is obtained by oxidation within the filter and from the atmosphere in the contact tanks. This particular process also includes conventional sedimentation tanks for solids separation and sludge digestion. However, the high rate filter and detention tank, acting as aeration and contact tank facilities offer the same elements for aerobic digestion as in the aeration and settling tank of the activated sludge process. To reproduce comparable conditions for aerobic digestion in the trickling filter system should require only sufficient recirculation to obtain the necessary oxygen and a suitable holding tank.

Consider for example, a typical small plant to serve 100 persons with a BOD of 0.17 lb. and a flow

4-D WROUGHT IRON PIPE



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New 4-D Wrought Iron has increased corrosion-resistance, improved mechanical and physical properties. It was achieved by substantially increasing the deoxidation of the base metal, slightly increasing the phosphorous content and using a more siliceous iron silicate.

Write for new 4-D Wrought Iron literature and specific technical information. A. M. Byers Company, Clark Building, Pittsburgh 22, Pennsylvania.

PIPE: THE MOST IMPORTANT SINGLE COMPONENT—Pipe for snow melting and radiant heating systems *must* resist corrosion. It is only accessible for repairs at considerable cost and inconvenience. Any leaks that might result are frequently difficult to locate with any accuracy. It is also virtually impossible to avoid some rough handling during the course of fabricating and installing such systems. So, strength is another piping must.

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of 100 gals. per capita per day, equivalent to 200 mg/L of BOD. If each recirculation over a high rate filter picks up a 4 mg/L of oxygen then, to satisfy the demand, the flow would have to be recirculated 50 times. In actual operation, however, since recirculation was needed to supply only 54 percent of the oxygen utilized by the sewage then in this example only 27 recirculations would be necessary. Offsetting this, however, is the apparent need for twice the amount of oxygen used in conventional plants, so instead of 27 volumes, 54 volumes of recirculation are required.

In the spiral contact aeration method, the filters are one foot in depth and dosed at 450 Mgad, or about 10,000 gal. per sq.ft. per day. The total head on the recirculation pump is 5 to 6 ft. In this typical example, with a flow of 10,000 gpd, the total recirculation for 54 volumes per day is 375 GPM, requiring at 75 percent efficiency a ¾ HP motor. The required filter would be 54 sq.ft. in area (8.3 ft. dia.) and one ft. in depth. The holding or settling tank should have a capacity of around 500 cu.ft. which at 10-ft. dia. will be 6.5 ft. ave. depth. On this basis, for 100 persons, a 10-ft. dia. tank surmounted by an 8-ft. dia. filter with overall depth of about 8 or 9 ft. will suffice.

For 1000 persons and the same unit flow and BOD, the plant would consist of a 26-ft. dia. filter, a 28 or 30-ft. dia. sedimentation unit with a 3750 GPM recirculation pump driven by a 7½ HP motor. This cannot be considered too visionary. Most of the unit loadings have already been verified in operating plants and the principal undemonstrated factor is the increase in recirculation necessary to reduce the organic solids by aerobic digestion. This factor as well as any other variations can be developed with available facilities at any of the existing spiral contact aeration plants or at a pilot plant built for this purpose. There is also the possibility of utilizing plastic media such as Dowpac, or other more efficient types.

The rapid development of fringe areas and the movement of industry into rural areas has brought a need for small complete treatment facilities between the septic tank and full scale municipal plant. This has been met in part by the small activated sludge plant designed amply enough to provide aerobic digestion of the volatile solids. There is no valid reason, technically or practical, why this method of treatment cannot be provided as well, possibly better, with trickling filters by applying principles already demonstrated. Costs both initial and operating should be less.

References

(1) Homer Knox, Progress Report on Aerobic Digestion Plants in Ohio, 1959.
(2) G. H. Hammond, Engineering Record, Vol. 74, 1916, Pg 448.
(3) F. G. Nelson, Spiral Contact Aeration in Biological Treatment, Jrnl. S & I W. Vol. 30, 1958, Pg 901.

• • •

Combustible Refuse Collection in Milwaukee

During 1958, the Milwaukee, Wisc., Bureau of Garbage Collection and Disposal collected 117,629 tons of combustible refuse. The average number of crews employed was 95.6 and they were employed for 257 days. Average collection per crew per day was 4.817 tons. On a unit cost basis, the cost of collecting garbage and combustible material was $22.73 per ton. Frequency of collection was 7.21 days.

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0.1

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PRECISION chemical feeding

The final test of any proportioning pump rests in its ability to get the "desired results" with accuracy, consistency and the least possible maintenance.

Maintaining proper chlorine residual, controlling pH effectively and feeding coagulants are just a few of the "desired results" that PRECISION chemical pumps have been achieving in the water treatment field.

These positive displacement pumps are guaranteed to meet the specifications of your health department. Here are some of the features these units offer:

- Compact-light . . . unit may be mounted directly on solution tank.
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- Handles full strength sodium hypochlorite solutions.

For further information, write Department 11A, Precision Chemical Pump Corporation, 1396 Main Street, Waltham 54, Massachusetts.

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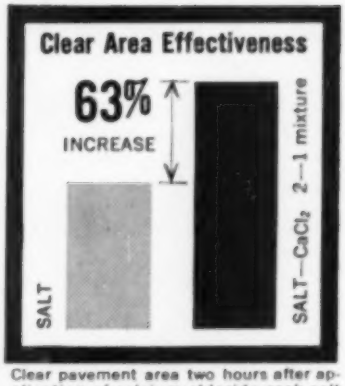
Columbia Calcium Chloride–rock salt mixtures keep roads open . . . costs and accidents down

Will you be getting a call from this disgusted driver? Keep complaints down, roads open and safe this winter with economical Columbia Calcium Chloride–rock salt mixtures.



Clear pavement area two hours after application of calcium chloride–rock salt mixtures is 63% greater than salt alone in 25-30° temperature range.

(Based on field studies in Michigan sponsored by the Calcium Chloride Institute)

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SAVE TIME, MONEY: Columbia Calcium Chloride and rock salt mix easily, can be stored indefinitely, ready for instant use. Bulk purchase and storage help stretch maintenance budgets.

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Air view of new secondary treatment facilities at Wichita, Kansas. Two 205 ft. dia. final basins, with Eimco-Process Clarifier mechanisms, have been completed and the third unit (lower left) is under construction. Consulting Engineers—Black & Veatch, Kansas City, Missouri.

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Repeat orders are a prime goal of nearly all businessmen, including those who manufacture sewage treatment equipment, and that is why we are proud to have been selected for the third time to supply clarifier mechanisms to the City of Wichita.

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There are good reasons for a customer to place repeat orders: excellence of equipment design, quality fabrication, thorough field service . . . plus that intangible "know-how". We would like to apply our years' of experience to *your* problem and earn your confidence, too. As a start, may we send you a copy of our new Bulletin SM-1005, "Eimco-Process Clarifiers and Oxidators®"?

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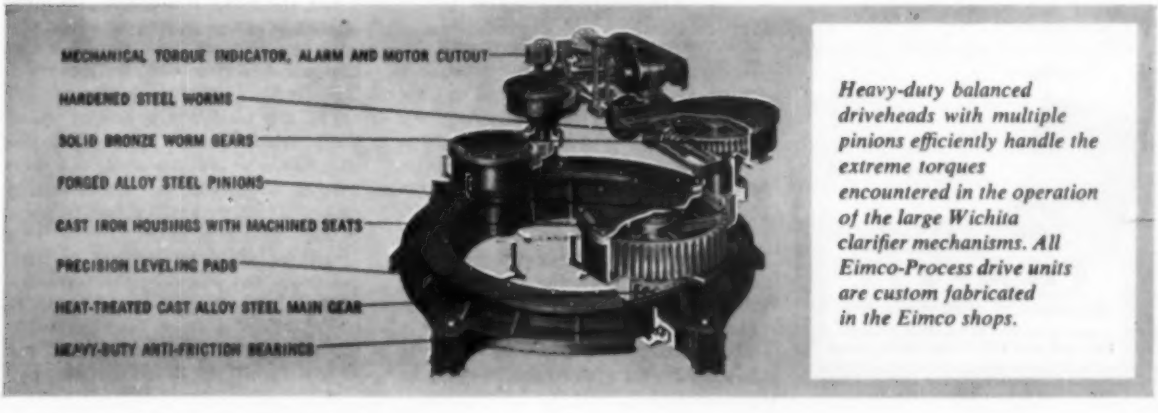
Process Engineers, Inc. Division
420 Peninsular Avenue, San Mateo, California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HEAVY-DUTY ANTI-FRICTION BEARINGS

Heavy-duty balanced driveheads with multiple pinions efficiently handle the extreme torques encountered in the operation of the large Wichita clarifier mechanisms. All Eimco-Process drive units are custom fabricated in the Eimco shops.

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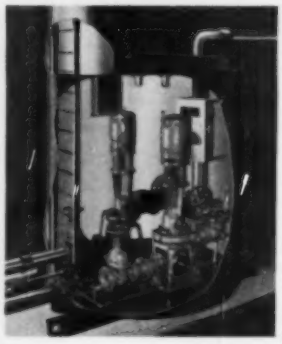

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  Compare motor and pump assembly of this duplex sewage pump station with any other and see the TEX-VIT superiority. Individual shaft for each pump and each motor. Four bearings per assembly instead of two. Heavy, corrosion protected steel shell.
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LEGAL ASPECTS OF PUBLIC WORKS

MELVIN NORD, Dr. Eng. Sci., LL.B.

Condemnation of Land for Highways

Hamer v. Iowa State Highway Commission, 98 N.W. 2d 746, an Iowa case decided Oct. 20, 1959, was a condemnation proceeding by the State Highway Commission. The Highway Commission condemned 9.12 acres of land in a strip one hundred fifty feet wide and one hundred sixty rods long, along the extreme easterly portion of Hamer's 280-acre dairy farm.

The contest was over the value of the land taken. The lower court granted the Hamers a judgment of $6350 and they appealed, claiming that the trial judge's instruction to the jury was incorrect when it stated, "The test is not what the land is worth to the plaintiffs, but what it is fairly worth on the market." Hamer contended that the correct measure of damages is a sum of money which equals the true cash equivalent of the value of the property taken for the highest and most valuable use to which the property could be reasonably used.

The Supreme Court of Iowa upheld the trial court's instruction and the original jury verdict, holding that the difference in market value is the correct test.

Attractive Nuisance

Swanson v. City of Marquette, 98 N. W. 2d 574, a Michigan case decided Oct. 13, 1959, was an action against the City for injuries sustained by an eight-year-old boy as a result of contact with high voltage equipment in an electrical substation owned and maintained by the City.

The plaintiff contended that the City had a duty to exercise a high degree of care in the operation of the substation, and that this duty required the construction of a vault and fence of such type that children could not easily enter it and come in contact with the high-voltage wires. Instead, the plaintiff said, the vault had a wooden fence around it, with holes in the fence and in the top of the vault. The substation was located within 100 feet of playground apparatus, and small children customarily played in the immediate vicinity.

It is recognized that municipalities are liable for injuries caused by attractive nuisances. However, under a series of Michigan cases, it had been held that the attractive nuisance doctrine did not apply where the child was a conscious trespasser before he was attracted to the danger site. That is to say, under past Michigan cases, the attractive nuisance doctrine applied only where the child would not have been a trespasser at all except for the fact that he was lured or enticed onto the land by the dangerous object.

The present case, however, squarely held that the current Michigan rule of attractive nuisance is in accord with that of the majority of jurisdictions,—that is,—"A possession of land is subject to liability for bodily harm to young children trespassing thereon caused by a structure or other artificial condition which he maintains on the land, if

(a) the place where the condition is maintained is one upon which the possessor knows or should know that such children are likely to trespass, and

(b) the condition is one of which the possessor knows or should know and which he realizes or should realize as involving an unreasonable risk of death or serious bodily harm to such children, and

(c) the children because of their youth do not discover the condition or realize the risk involved in intermeddling in it or in coming within the area made dangerous by it, and

(d) the utility to the possessor of

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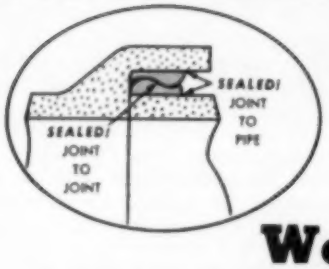

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maintaining the condition is slight as compared to the risk to young children involved therein."

It was thus held that the trial court was incorrect in dismissing the action. The case was therefore remanded for trial.

Change of Grade of Sidewalk

McDonald v. City of De Pere, 98 N.W. 2nd 407, a Wisconsin case decided Oct. 6, 1959, was an action by landowners against the City to recover damages for a change of grade of a sidewalk.

The plaintiffs purchased a large residence property having a frontage of 101 feet on the west side of North Broadway Street in the City of De Pere in 1941, and have owned it continuously ever since. At the time of the purchase, the street was already improved by pavement, curbing, and a public concrete sidewalk paralleling the street. A private concrete sidewalk led from the public walk into the house and two paved driveways led from the street into the property, one on the north and one on the south side of the house.

In 1953, the state highway commission drafted plans and specifications for repairing the street and installing a new curb and public sidewalk, which required the raising of the existing levels of both the street and the walk. The city by ordinance adopted the new grades for the street and walk called for in these plans.

Because the new public sidewalk was raised 6-8 inches above the level of the former walk, the plaintiffs found it necessary entirely to replace their private walk leading into the house, to raise the east portions of the two private driveways to the level of the new public walk, and to put in a fill of black dirt in their front lawn to bring it up to a level where water would not accumulate. The total cost of these improvements was $960.35.

The plaintiffs filed a claim for this amount against the City. At the trial, the plaintiff was allowed no recovery. On appeal, the Supreme Court of Wisconsin held that he was entitled to a recovery if his original sidewalk, etc., was made in reliance on an existing grade. Thus, the case was sent back for retrial in accordance with this rule.

Cost of Sewer Line Maintenance

The cost of maintaining sewer lines in Arlington Co., Va., totaled $142,686, an average of $367.06 per mile or 82 cents per capita for the fiscal year 1959.

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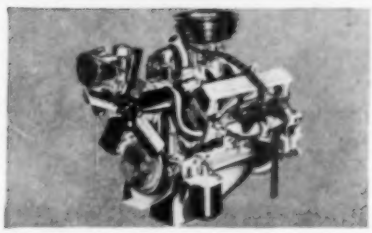

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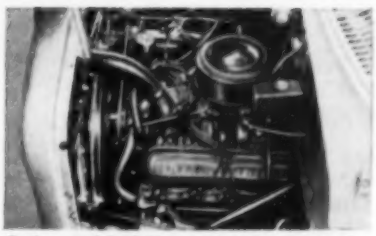

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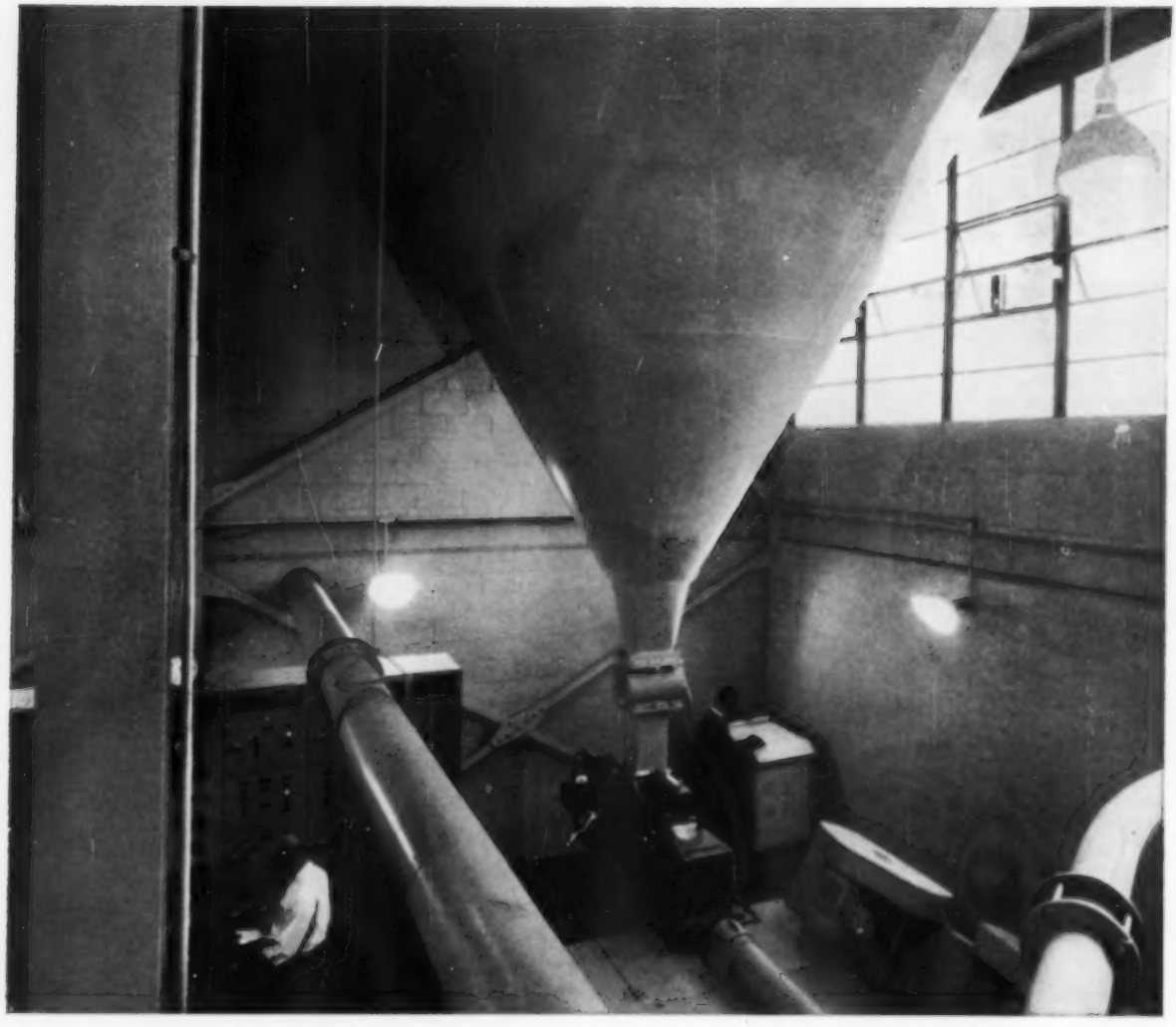

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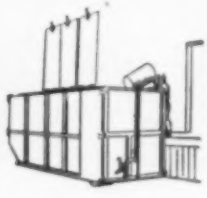

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Why Dallas County, Texas, chose

3 CAT No. 12 Motor Graders on "Best Bid"

After studying the cost of equipment, officials of Dallas County, Texas, recently approved the purchase of 3 new Caterpillar No. 12 Motor Graders. The reasoning was simple, according to the Dallas *Times-Herald:*

"Comparative figures from the county auditor indicated the new Caterpillar No. 12 Motor Graders, as opposed to other makes of machines, would have the lowest last cost. Assuming the machines would operate a total of 16,000 hours over an expected 8-year life, the *cost of repairs* for each Cat Motor Grader was estimated to be $3,264; Brand B, $15,073; and Brand C, $16,864."

In addition, according to previous cost records, a 1956 model No. 12 had been operated by the county for 2,524 hours without repair to the clutch. Total repair costs for the machine had been less than a dime an hour.

In short, cost records proved Caterpillar offered the county the lowest "best bid" dollar for dollar.

More and more public and governmental officials, like those in Dallas County, have discovered that the "best bid" method of machinery purchasing—actually lowest total cost—points to Caterpillar. Here's why: greater dependability, lower repair costs, better performance, and higher trade-in value for every piece of Cat-built equipment.

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PUBLIC WORKS
Magazine
Volume 91 • Number 1
January 1960

● TURNPIKE roadways at this point in northern Summit County have elevation differential of 68 ft. Note lined gutter at left foreground to protect shoulder from erosion.

Control of STORM WATER on the Ohio Turnpike

L. G. BYRD,
Maintenance Engineer,
Ohio Turnpike Commission

IN THE COLD and unpredictable wintertime of Northern Ohio, the icy winds from Canada and the soft humid breezes from the south battle for supremacy of the skies over the southern edge of the Great Lakes. No matter which side wins, the usual deposit of moisture makes the Ohio Turnpike the loser. While snowfall is our typical opponent during the winter season, Ohio has also experienced some of its most devastating floods during January and February.

During January, 1959, Ohio suffered from flooding conditions throughout almost all sections of the State, resulting from a 24-hour downpour which deposited over four inches of rainfall in many sections. Again in February, flooding conditions resulted from a 24-hour rainfall exceeding two inches. In both instances run-off conditions were made most acute by frozen, snow-covered ground.

The Ohio public highway system sustained damages estimated at almost $1,500,000 during these floods and had over 300 different road closures at one time. As J. William Reppel, Engineer of Maintenance for the Ohio State Highway Department, aptly stated, "We had detours on our detours."

Throughout this troubled period, the Ohio Turnpike was "high and dry" along its entire 241-mile path across the varied terrain, from the hilly borderlands of Pennsylvania to the flat and fertile farmlands of Indiana. This fortunate status has remained unchanged during the brief but busy history of the four-year-old super-highway.

Credit for excellent drainage facilities constructed as a part of the Ohio Turnpike must start with the J. E. Greiner Company, consulting engineers of Baltimore, Maryland, which served as general consultants to the Commission during the design and construction of the Turnpike. The comprehensive and far-sighted drainage design standards established by the Greiner engineers provided for:

1) Storm sewers designed for a rainfall frequency of 25 years, except where serving depressed areas of roadway subject to ponding (as at low points in cuts) where design standards were based on 100-year frequency. In both instances, design provided for a maximum surcharge not above the bottom of the inlet grate.

2) Median and shoulder ditches designed for a 10-year rainfall frequency. Median inlet spacing for a maximum width of flow of ten feet (in the 40-foot-wide, depressed, turf median) with a maximum spacing of 1,000 feet.

3) Secondary ditches designed for a 10-year rainfall frequency at tops of cut slopes and bottoms of fill slopes where erosion problems or primary ditch capacities warranted.

4) Pipe, box and arch culverts designed for a 100-year rainfall frequency, with surcharge at the culvert entrance no greater than two feet and not higher than one foot below the edge of the roadway shoulder. Culverts are also designed to prevent undue damage to adjacent property from ponding during design flood stage.

While the Ohio Turnpike has never suffered a closure or inundation from storm water (or any other cause for that matter), we have not been without our share of drainage maintenance problems. During the

● **CONSTRUCTION of discharge end of reinforced concrete outfall into the Black River (in Lorain County), illustrating size of structures necessary to carry off storm waters. Storm sewers were designed, in most cases, for 25-year rainfall frequencies.**

first year or so following the opening of the Turnpike, we were plagued with the not unexpected erosion of the many bare or lightly-turfed slope faces. This problem quickly became acute in the two westernmost counties where the Turnpike alinement passed through the fine sandy loams predominant in that area. The Wauseon Interchange connecting the Turnpike with State Route 108 in Fulton County was particularly affected. There, embankment fills were so severely eroding that it was necessary to construct extruded asphaltic concrete curbs to control run-off and divert it into corrugated metal pipe flumes outletting into toe-of-slope ditches. All work was performed by maintenance personnel using Turnpike-owned equipment, except for the curb-extrusion machine which was rented.

Erosion problems during the early seasons of Turnpike operation led also to considerable silting of side ditches, culverts and channels. An early and full scale ditch and culvert cleaning program had to be inaugurated to maintain proper drainage capacities at locations throughout the length of the route. With slopes now fully turfed, a repetition of the ditch and culvert cleaning cycle is not anticipated for several years.

Maintenance of Paved Gutters

Perhaps the single, most vexing drainage problem—and one that has not diminished with age—has been the maintenance of paved gutters. Design standards were established to provide for an economical facility with an accepted risk on long-range stability. Typical standards called for the invert and sides of the specified ditch section to be paved with four inches of plain portland cement concrete. Paved cross-sectional areas were determined by capacity requirements as controlled by earlier listed design standards. The leading edge of all paved sections were designed with two-foot-deep cut-off walls to prevent infiltration of water under the pavement at this point. Failures in paved gutters can be generally classified in the following categories:

1) Undermining of pavement due to infiltration of water at leading edge.

2) Washing and ultimately undermining outside of gutter edges.

3) Infiltration of water through cracks leading to undermining.

4) Overflow and resultant undermining of pavement surfaces.

Corrective measures on failing or failed paved gutters have included a wide variety of materials and techniques. Where undermining has started but pavement sections are still intact, pumping of a cement-sand slurry into all voids has proven fairly successful. This work has been accomplished, using a Koehring No. 10 Mudjack where pressure has been required to fill void spaces. Sealing of minor cracks and joints with an asphaltic joint sealing compound, applied with a caulking gun, has shown some promise as a preventive measure. Where complete or near-complete failures have occurred, we have elected to re-establish new inverts on flatter slopes

● **FORMING, pouring and finishing a typical paved gutter. Median and shoulder ditches are designed for a 10-year rainfall frequency; secondary ditches also for a 10-year frequency (see preceding page); and culverts to pass a 100-year rainfall.**

with several intermediate check dams. In most instances, the old broken pavement is used as rip-rap on the new cross sections.

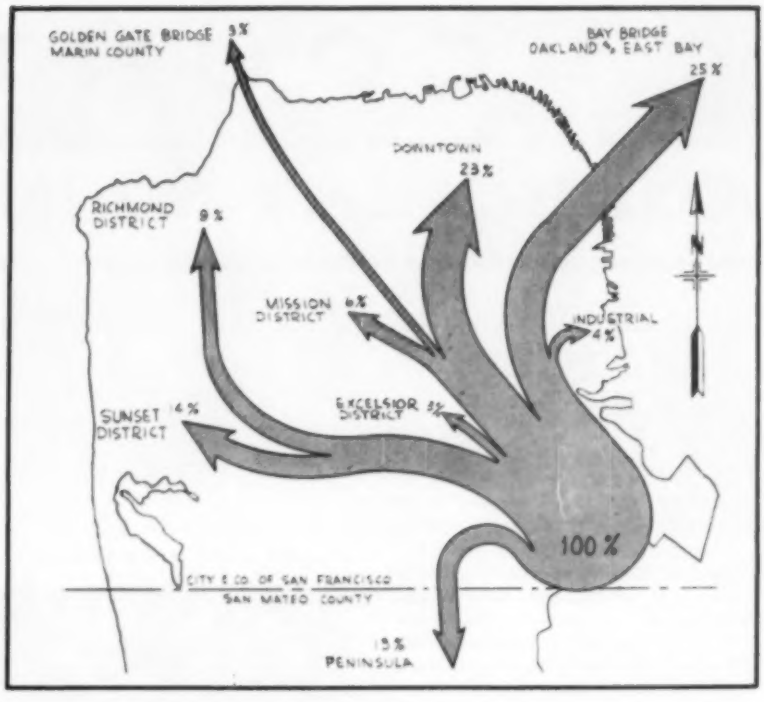
Culvert Cleaning

Maintenance of pipe culverts and drains has consisted primarily of cleaning operations. Structural failures have been so minor and so infrequent as to merit little mention. Some re-grouting of concrete pipe joints has been required. Bituminous coatings and invert pavings on metal pipes have required periodic patching. The action of scour and ice lenses continues to expose bare metal. Patching work has been done by hand painting with liquid asphalt, but the resultant coating is relatively thin and of limited value. Cleaning operations in pipes, up to 36 inches in diameter, have been performed, using a set of Flexible disc scrapers. For large pipe and box culverts, a Sauerman bucket has been employed with considerable success. The scrapers or buckets are winched through the culvert on a cable and sheave rig, using a traveling tractor or grader as the power source. A search was made for a double drum hoist on a portable frame suitable for this work but to date we have found none to fit our needs.

Miscellaneous problems on drainage facilities include the repair of damaged flood gates, the protection (usually by check dams) of eroded sod ditches, the constant surveillance of all culvert entrance conditions, and the repair of flood-damaged right-of-way fencing.

In summary, the design standards for control of storm water on the Ohio Turnpike have successfully provided us with a facility free of damage or closure under the most severe of flooding conditions. Structurally, our facilities have required a minimum of maintenance with the exception of paved gutters and ditches. The failure of many paved gutter sections points up a need for greater care in construction of cut-off walls and positioning of inverts. Where severe conditions exist, the construction of a more costly, but more permanent, type of installation warrants consideration.

The success of our drainage installations to date has not led us into a sense of false security however. It is our firm belief that a properly functioning, well maintained drainage system is the key to the successful maintenance of the Ohio Turnpike. Toward this objective our men, equipment and talents are continually directed.



TRAFFIC PLANNING FOR A BASEBALL STADIUM

CONSIDERABLE study was devoted by the Traffic Engineering Division of the Bureau of Engineering of San Francisco to the design of an effective traffic layout for the new municipal baseball stadium near Candlestick Point. Since the area was largely undeveloped, it required a new roadway network to connect it to major traffic arteries. The study divided itself into three general parts: 1) Origin and destination of traffic; 2) design of road system; and 3) operational plans.

For the purposes of design, it was assumed that peak traffic volumes from a capacity crowd existing from the stadium would, on occasion, coincide with the peak volumes of normal traffic on major trafficways. This was the critical criterion since pre-game stadium-bound traffic will most likely, be less concentrated than postgame traffic. The total amount of stadium traffic was determined by the capacity of the parking lot, 9,000 cars. To determine where traffic came from and went to, an assumption was made that game attendance would be proportioned directly to the population of given geographical areas and inversely to the distances to be traveled. The nine Bay Counties were assumed to contribute practically all the patrons. The extreme distance involved was 100 miles. This analysis shows that about 60 per cent of traffic would come from San Francisco.

Because of the short periods of high peak demand, it was decided early in the study to make the major traffic routes reversible one-way streets with parking prohibited on these streets during pre- and post-game periods. Some streets were restricted to use by either private autos or public transportation. The routing was designed to minimize conflicts and to eliminate cross flows where possible in order to increase traffic capacity. Particular care was taken to avoid need for any significant volume of pedestrian traffic to cross a major vehicular flow.

The operational problems involved are the changing of signal control apparatus and the retiming of signals to fit these unusual peak conditions; determination of the types of "No Parking" and "Towaway" signs that will be needed to denote these parking control measures on ball game days; the installation and operation of part-time one-way signs; and control measures to turn back traffic bound to the ball park when the parking areas become filled.

COUNTY EQUIPMENT MAINTENANCE

JAMES F. MEISNER,
Marion County Engineer
Marion, Kansas

THE MAINTENANCE of equipment required to construct and maintain 1,623 miles of county road calls for a smooth working crew of operators and maintenance men, especially when this work must be performed on a minimum budget.

Marion County varies from hilly and rocky on the east side to flat and gummy on the west. There are 310 miles of county Secondary roads, 13 miles of county road and 1,400 miles of county Class B roads commonly known as township roads. Of these, approximately 170 miles are asphaltic sealed roads, 850 miles are light type surfaced roads and the balance are non-surfaced roads.

In general, we have adopted a standard of 26-ft. shoulder to shoulder width on county and Secondary roads and 20 to 24-ft. widths on the township type roads. To keep the maintenance operations on schedule, 23 motor graders are operated with one extra for a spare. These 24 motor graders consist of 19 Caterpillar No. 12s and 5 Caterpillar No. 112s. We propose to replace these units, first eliminating the smaller units in favor of the larger, at the rate of about three units each 2 years and have followed this procedure for the last 12 years. This means that we must purchase and plan to keep in operation each motor grader on an average of 15 years. Actually, we have had some machines in operation that are over 20 years old.

The solution to our first maintenance problem, then, is to have a machine that does not become obsolescent in 20 years; a machine that has repair parts currently in stock over a long period of years and not at a premium because of change in models after a few years. A second maintenance problem we feel that we have solved is to make a complete repair when we once tear a machine down. When we first started this work, we would think it economy to replace only the broken or worn gear. Today we almost invariably replace all matching gears. It seems wasteful to discard a good gear but, with experience, we find that too often a new gear against a worn gear makes two worn gears, whereas two new gears meshing together puts the machine back in a new condition as far as these gears are concerned. Some salvage is gained if one of the gears is not too badly worn and it is saved to be used as replacement in a machine that is assigned only light work. We feel that this one feature in our maintenance has reduced our repair problem rather than increased the cost.

Another item which comes in the preventive maintenance category is to match your machine with the work at hand. We have adopted the policy of purchasing the heavier machines for our maintenance work. In reality, we probably do not need the heavier Caterpillar No. 12 type of machines for maintenance work; that is for regular surface maintenance, but when snow removal comes the heavier outfits pay off as they are sure to go through a drift. Also, we find that when you overstress a machine you invariably have breakdowns in emergencies. We also have the policy of using our machines for dual purposes. First, they are maintenance machines for both surface maintenance and snow removal. Second, they are construction machines when not used for maintenance.

● **SHOP pick-up truck with the Shop Foreman, Mr. Meierhoff. This truck is equipped to carry all necessary tools and to trail the welder. It has two-way radio.**

Since our county has its share of rock and gumbo, we often find that we demand the utmost from the machines in grading. Here we think the heavier machines prove their worth in the fact that they are not working in an overstressed condition though rolling a large windrow of earth. We know that, as we have been successful in building up our inventory with heavy machines, our repair and breakdown time has been reduced.

To supplement on grading work we have four Caterpillar D7 tractors equipped with dozers and scrapers; one old Caterpillar RD7; and one old Diesel 50 with scraper, as well as two Caterpillar D4s and two

Allis Chalmers K tractors with 2-yard scrapers.

These tractors are used to make cuts and fills, doze hedges, trees and rocks and otherwise do the work necessary to complete our road construction and maintenance work.

Actually, we should replace some of this crawler equipment, but it is my candid opinion that whenever the opportunity presents itself in our budget we should reduce this type of equipment to about 3 or 4 large tractors with dozers, snow plows and scrapers and two or three smaller tractors with dozers and scrapers for bridge and culvert work; and then add to our inventory with about three rubber tired tractors and scoops. We find that our cuts and fills are requiring increasingly longer hauls and these rubber tired outfits will reduce our maintenance on the steel track equipment.

We feel that one of the main problems in preventive maintenance starts with the procuring of the equipment with which we expect to execute the work. Small, overstressed outfits, adequate but misassigned outfits and obsolescent outfits all tend to increase the maintenance problems and costs of any construction or maintenance crew.

Truck Equipment

In our truck inventory we operate four 4½ to 5-yd. dump material trucks; 5 flat bed trucks with winches; and two truck-tractors for hauling equipment, road oil and material. These trucks are all Fords and Chevrolets with the exception of one of the truck-tractors, which is a Dodge. The material trucks will operate around 35,000 miles per year. The flat beds will operate around 12,000 miles per year with considerable winch work, and the main truck-tractor about 40,000 miles per year.

It is our policy, in the purchase and maintenance of our truck equipment, to purchase our trucks locally for the twofold reason that the local dealers carry a complete line of repairs and make them available to us at a county discount and they maintain adequate shops for repairing in time of need.

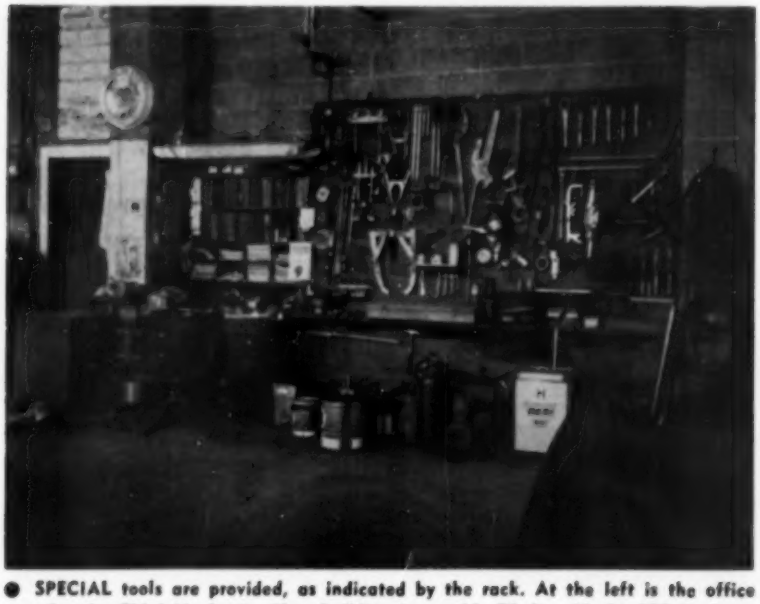
● **USING a traveling overhead crane, one man can remove the engine from a motor grader easily. Background shows general arrangement of the interior construction.**

We feel, in the organization of our repair shop, that it is more economical to man our shop with full-time employees in sufficient number to handle normal repair needs. This normal repair need includes all the repair of the heavy equipment and such repair of the truck type equipment as we have time to do. By using locally available facilities we can, in time of stress, assign repair work to the local shops. This pays off in two ways. First, it speeds up the repair time, as our dealers cooperate and work out our repairs ahead of their routine work in appreciation of our patronage; and second, it eliminates idle time of extra mechanics between jobs at the shop.

Other allied equipment consists of a Galion self-propelled 12-ton steel flat wheel roller; a Ferguson 11-wheel pneumatic roller; a Hough pneumatic loader; a Standard Steel 1,000 gallon construction distributor on truck; a Traxcavator; a Standard Steel 600 trailer type patching distributor; a Heat-a-Mix tailgate heater; an Allis-Chalmers tractor; a Danco rotary mower; plus other tractor equipment and several small wheel tractors.

This rather generally covers our operations in Marion County and points out our need of an adequate repair shop.

The county shop building was built in 1948 shortly after the county adopted the County Unit System wherein we took over the construction and maintenance of all township roads as well as our own county road system. The shop is roughly 71 ft. wide by 121 ft. long. The shop section is on the south side of the building. The area north



● **SPECIAL tools are provided, as indicated by the rack. At the left is the office area for the Chief Mechanic. Shop building is roughly 71 ft. wide by 121 ft. long.**

of the shop section houses the parts room; toilets; tire room; laboratory; concrete culvert construction shop; employees briefing and tool room; two truck storage spaces; and welder's steel supply room. The tire room was originally planned to be the Engineer's office, but it was later decided the Engineer could best serve in the Court House where all county records are readily available.

The shop section consists of three repair stalls, one welding and machine shop stall or area and one washing and greasing stall. All stalls are open, excepting the wash and grease stall, which has a half wall that acts as a back wall to the machine shop area and a protection against splashing water from the wash room.

The stalls themselves are 36 ft. deep. The doors are 12 ft. wide by 12 ft. high. This area allows all of our present equipment to enter. Along the north or inside wall of the repair stalls we have constructed a mechanics' bench, as there is sufficient room for work between the end of a grader and the bench.

The shop itself is equipped with a valve grinding machine; brake shoe machine; heavy drill press; metal lathe; 80-ton press; electric and gas welder; portable electric welder; column grinder; anvil and an assortment of tools and small equipment.

We man the shop with a shop foreman, a welder-mechanic and a mechanic. They have a pickup truck for their use in the field. The pickup is equipped to carry all necessary tools and to trail the portable welder; and is also equipped with a two-way radio. This radio has saved many long runs back to headquarters in busy seasons, as the mechanics never leave a field call before calling in to see if they are needed elsewhere in the vicinity.

It is our policy not to make major repairs in the field. We feel that the hazard of getting dust into the working parts of our equipment will justify the expense of moving the equipment in to the shop and back. We do, of course, make minor repairs and adjustments in the field.

We attempt to keep only such repair parts on hand as we need recurringly, such as gaskets and other minor items which need replacing at more or less regular intervals. We find that most accredited equipment dealers keep an adequate stock of repairs on hand and that we can, as a general rule, order and have our repairs delivered by the time we are ready to reassemble the equipment. Also, we tag and stock all items we salvage off a regular repair job for use on jobs where we do not attempt to make a complete repair job.

When a new piece of equipment is purchased, a file is made for the item on which is listed such pertinent information as the dealer's name and address; the manufacturer's name and address; serial number of equipment and any of its parts; various parts size; and other information that will eliminate the necessity of hunting up specifications if such data has been lost or worn off the equipment or of making a trip to the equipment if it is in the field.

Into this folder then goes all shop job orders and a record of all mechanical work on the equipment. This record is very valuable in subsequent repair jobs, as it gives a running account of the repairs on the equipment. This record is also made available when the equipment is sold or traded and in most cases tends to help on the resale value.

The shop job order was made up to our own specifications and we feel serves our purpose. Basically it is a form on which the chief mechanic lists his estimate of the parts required. He then notes on the form the parts on hand and orders the balance from the dealer. As the work progresses the parts actually used are listed together with mechanic time, mileage and other shop costs. Also on this form the speedometer mileage or hour meter reading is noted at the time of each repair in order that we might know the performance between jobs.

These shop job orders are printed in duplicate; one copy is submitted to the office where they are processed and all costs extended and totaled. The other copy is kept in the equipment file. These totals are then posted in the office equipment record and from this record we set our operating charges for the various pieces of equipment.

Maintenance in Marion County starts with the procurement of adequate equipment; a smooth working organization with cooperation between the operators and the shop; and an adequate shop with skilled and qualified mechanics who see their job not as repairmen but as maintenance men whose job is to keep the equipment running.

Ramp Resurfaced with Rubberized Asphalt Mix

THIS approach ramp of the Ohio Turnpike at the junction of U.S. 21 is being resurfaced with a rubberized asphalt compound made by mixing a latex compound of the Xylos Division, Firestone Tire and Rubber Co. with asphaltic concrete. The result is a tough pavement, capable of withstanding the pounding and abrasion of heavy traffic. The rubberized asphalt will not turn brittle and crack in cold weather or become tacky in the summertime. This type of pavement can be applied in relatively thin courses, thus reducing material costs.

Extending and Metering a WATER SYSTEM

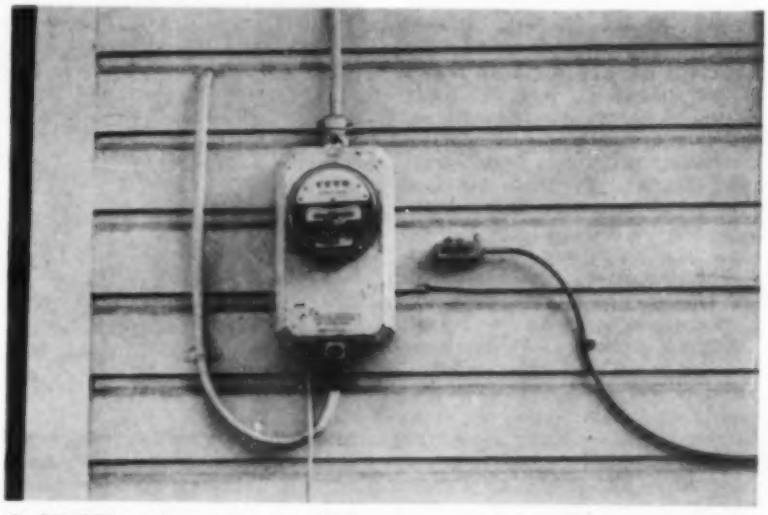
UNTIL ABOUT a year ago, Rock Falls, Ill., was supplied with water by a private company. The new facilities and extended lines demanded by the rapid growth of the area had not been supplied by the water company, resulting in a large number of home water installations. Subsoil conditions favored this, with ground water only 20 feet down; but deeming public ownership desirable, the city purchased the water system. Last spring a program was begun which will provide water to about two-thirds of the population of 10,500.

This will involve laying 10,000 ft. of 12-in. pipe; 15,000 ft. of 10-in.; 25,000 ft. of 8-in.; and 45,000 ft. of 6-in. All excavation work was handled by an International 460 industrial tractor equipped with an IHC Pippin 460 backhoe. Another 460 tractor with a Pippin loader was used to lower the pipe into the trench and to backfill. An average of 600 ft. of line was laid per 7½-hour day.

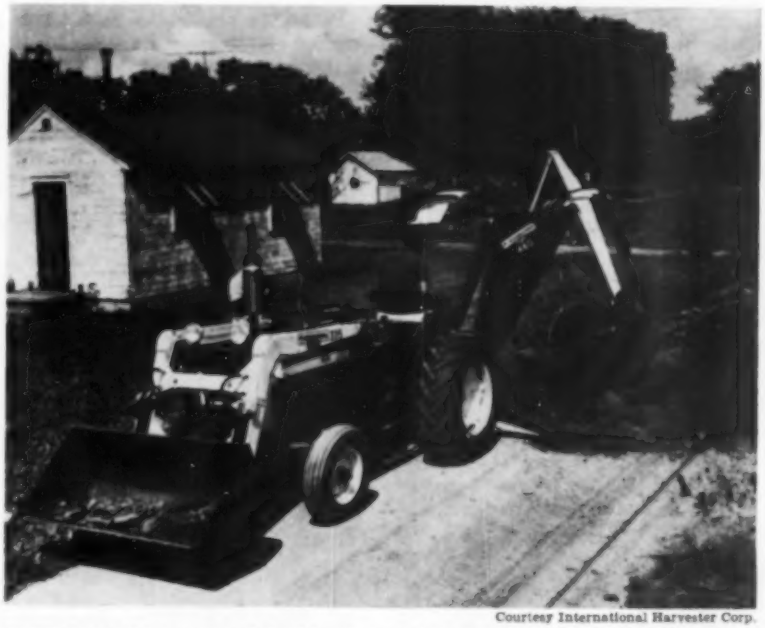
An interesting phase of the project is the installation of remote registry for the water meters, using Visi-Meter Equipment. These are being installed by three teams of two men each. Such a team can install a remote registry unit in 30 minutes with one man handling outside installation and the other making the necessary connections in the basement. The first installation program, using the Visi-Meter, involved 1,500 customers where Trident, Badger and Buffalo meters were fitted with remote reading registers. One team makes 15 to 18 installations in an 8-hour day, working from 9 AM to 6 PM to avoid problems of access to the meter; or work will be done after 7 PM if requested by the customer. The day these installations began, a special radio announcement was made by Leonard Skaggs, Water and Light Superintendent, to inform the public of the program.

Visi-Meter equipment is an attachment to the water meter, using a special speedometer cable, housing and water-proof vinyl covering. The register, which also is specially designed, has a seven digit straight reading type register such as is used on automobile speedometers. The contract for the water meter registers was awarded to the Visi-Meter company on the basis of quality of material and workmanship, though the bid price was the highest received.

A major economy will result by utilizing the present light meter readers also to read the water meters. An outside reading device placed near the light meter, completely eliminates the necessity of employing any new men to read water meters for the new utility. This in essence is doubling the utility service to the City.



● **REMOTE** *reading registry installation on the exterior of the house is simple and expedites reading of meters by permitting one reader to handle two reading jobs.*



Courtesy International Harvester Corp.

● **INDUSTRIAL** *tractor with backhoe is used by the Rock Falls Light and Water Department for trenching for 95,000 feet of 6 to 12-inch pipe to serve the community.*

AERIAL PHOTOGRAPHY and PHOTOGRAMMETRY

E. L. SHERERTZ,
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Division of Highways

USE OF AERIAL photography in the Illinois Division of Highways for location and design has developed through the years since 1937. The first photography was purchased at that time—some from the Agricultural Adjustment Administration and some from the U. S. Geological Survey. It has been used extensively since then in the preparation of county highway maps. Most of these maps are drafted at a scale of 1″=1 mile. The photography is used to plot the planimetric features within the land section grids without aid of the stereo plotter.

Statewide photography for location was not utilized, generally, until about ten years later. At this time some engineers, responsible for location studies, began using photostatic copies of the photography reproduced at a scale of about 1″ = 1,000′. Photostats were mosaiced together for preliminary reports. This photography continues to be valuable to the planner and often small and medium-sized drainage areas are outlined by stereoscopic examination checked by field inspection for area measurement.

The first attempt to prepare plans for contract by photogrammetric methods was in 1952, when a contract was awarded to an aerial mapping company to furnish a map covering a corridor approximately 2,000 feet wide and 5 miles long, at a scale of 1″ = 80′, with 2-foot contours. After the alinement was fixed on the map, information for plan-profile and cross-section sheets was taken from the map. This first job was strictly on a trial basis and a conventional field survey was later made of the entire alinement. The first trial was not considered adequate for plan quantities, but the map was well worth its cost for location.

In 1955 a total of 40 miles were placed under contract to three mapping firms. The mapping requirements were varied at this time in an attempt to arrive at the optimum for solution of highway problems.

● **ELECTRONIC computer section. To compute and adjust the Tellurometer and theodolite traverses, the computer is used. This gives quicker and more precise results.**

Although none of the alinement mapped under the agreements made in 1955 has actually been placed under contract, spot checks indicate that the information obtained is within permitted accuracy tolerances.

In 1956 a section for aerial surveying was created in the Bureau of Design to establish policies and service contracts and to further the use of photography and photogrammetry in the Division.

● **TELLUROMETER gives the control survey party seven-league boots for their second-order horizontal measurements.**

The Cessna 310 owned by the Division was altered to accommodate a Park Precision Aerial Mapping Camera, and an aerial photographic laboratory was equipped and staffed. A large project, consisting of photographing approximately 1500 miles of the interstate system at a scale of 1″ = 800′, was initiated immediately. This was accomplished in the summer and fall of 1956. Strip mosaics, or rather stapled assemblies, were made and copied on 30″ x 40″ film at a scale of approximately 1″ = 600′. The existing landmarks—road numbers, north arrow, etc., were drafted on the copy negatives. Blueprint copies, made directly from the large negatives, are used as work sheets.

The continuous strip mosaics were used for the cost study and are in constant use for access control planning. When the access control is decided upon, it is drafted on the original copy negative, showing alinement, road closures, grade separations, interchanges, frontage roads, property ownership, etc. The access control plan prepared in this way is not only satisfactory for presentation to the Bureau of Public Roads, but is valuable for explaining the plan to owners and officials.

Stereoplotting equipment could not be purchased over the counter

● KELSH plotter in operation. The division now has four stereoplotters and it has been necessary to organize and conduct a training program to insure operation.

in 1956. Several states and private mapping agencies were either beginning similiar operations or increasing their existing capacities. The first Kelsh Plotter was received late in 1956 and three additional plotters were received early in 1957. The acquisition of plotters did not place the mapping section on an immediate production basis. First of all, it was necessary to train operators. A training course was organized and nearly completed prior to the arrival of the plotters. The next step was for the trainees to become proficient by actual operation. Two additional training courses have been conducted, and for the time being, at least, there is an operator for each plotter.

Field Control

A panel truck was purchased for transportation of the field survey equipment. The field control work for the individual projects is handled by district personnel in the respective districts. A liaison man coordinates the work of the control survey party with the requirements for photogrammetric plotting. Specifications for field control work have been printed, including representative samples of both horizontal and vertical control photographs.

Both horizontal and vertical control must close with an accuracy of third-order or better before adjustment. A one-second optical-reading theodolite and a self-leveling level are used for the field control. Where possible, the surveys are initiated and closed on USC & GS control and the mapping is prepared on the State Plane Coordinate System. In locations where the project is far removed from USC & GS markers, an artificial grid is established, but all elevations are based on the 1929 mean sea level adjustment. USGS bench marks are well distributed over the State and are utilized to their fullest extent. Where the traverse cannot be tied to USC & GS horizontal control, astronomical observations are made for azimuth determination and the traverses are closed.

● FIELD control, using the Wild T-2 Theodolite for angle measurement. Instrument man Meredith Saxer is shown at work here and on the facing page.

A Tellurometer has been secured and thus far is used for the most part by the USC & GS for establishing second-order control along approximately 750 miles of the proposed interstate system. The State's own forces have completed four Tellurometer traverses, dovetailing their work with that of USC & GS. It now appears that this new measuring equipment will enable all future projects to be tied to the State Plane Coordinate System. Judging from the results of the first electronically measured traverses, better than third-order closure may be realized and possibly made a requisite.

The Division is using a Bendix G-15D Computer to compute and adjust the traverses. Not only is the computer more rapid, but the many errors that invariably occur in the desk calculator method are practically eliminated.

Grids are constructed and control positions are plotted manually. Construction and checking the grids are time-consuming and plotting of control is subject to error. There can be no doubt that the purchase of a coordinatograph is justified, and one will be installed as soon as space is provided.

The mapping being done is quite varied. Each project is tailored to obtain the desired end result. For preliminary engineering, a scale of $1'' = 200'$, with a 5-foot contour, is predominantly chosen. A good map at this scale is particularly valuable for location studies where the terrain is rough or in built-up areas where right-of-way is a prime consideration. When compiling at a scale of $1'' = 200'$, it is imperative that the photography be planned at an altitude of 6,000 feet above the mean terrain when using a 6-inch focal length lens. Horizontal and vertical controls must be planned to fit the photography.

Proposed Alinement

Staking the proposed alinement on the ground, after determining its proper location on the small-scale map, is a straight-forward process. It should be borne in mind that at this stage cross-sections have not been taken and a few feet of varia-

tion in alinement is not important. After the alinement is positioned on the map, the coordinates of P.I.'s and P.O.T.'s are scaled from the stable-base map. Ties to the original horizontal control are then computed and alinement is staked directly on the ground. The correct alinement may be cleared through timber areas with assurance that it will end at the right location. It has been found to be a distinct advantage to place the proposed alinement on the photography for the benefit of the field party. This may be done by computing an average scale for the photography. Enough points must be transferred, from the map to the original photographs, to eliminate the effects of tip, tilt and relief distortion. As the staking of the alinement progresses on the ground, the field party chief may assure himself, by observation, that the line is passing through or near the proper picture points. Placing the alinement on the ground within 5 feet of the proposed location is not difficult

Experience has indicated that quantities may be calculated from the preliminary 200-foot per inch, 5-foot contour map, within less than 10 percent of the final results of large-scale photogrammetric work or conventional field methods. Quantitative results from small-scale maps are dependent upon the terrain. In flat rural areas the location may generally be decided upon with the aid of existing quadrangle maps and stereoscopic study of the photography. Since 5-foot contours are meaningless in flat areas, it is necessary to read a multitude of spot elevations. The spot elevations may be read with a much higher degree of accuracy than attempting to interpolate elevations between widely-spaced contours.

Quite contrary to statements previously made concerning the ease of locating the proposed centerline on the ground from the preliminary map, establishing the centerline from the large-scale map after cross-sections have been taken is extremely difficult. The line and stationing must be within approximately 1 foot of the map position in order for the cross-sections to appear realistic. In so far as earthwork quantities are concerned, it is doubted that this degree of accuracy would be required, but engineers and construction contractors will not be pleased with cross-sections that appear to be misplaced a few feet.

For these reasons the alinement, or at least a base line that will appear within the limits of the cross-sections, should be staked and paneled prior to final photography, and preferably the field profile should be taken prior to plotting. The field profile enables the operator to index each cross-section to a known elevation and the panels insure its proper positioning. No attempt is made to place panels on the ramps of an interchange area, although panels are invariably placed on the crossroad, as well as the proposed alinement through the area.

Final Mapping

Most final mapping is compiled at a scale of $1'' = 50'$, with 1-foot contours. Additional spot elevations are read from the model in those areas where contours are widely spaced. If cross-sections are to be computed electronically, a planimetric map is ordinarily plotted contouring areas adjacent to proposed drainage structures. The cross-sections are read from the stereo model. Electronic or mechanical equipment is not being used for transferring the information to the computer tape. Lines are constructed perpendicularly to the tangents and normally to the curves on a vellum overlay. The spot elevations are indicated at the breaks by the plotter operator and later the distances from center-line and elevations are read into a recording machine, from which the computer tape is punched.

For interchange areas where the final alinement of the individual ramps has not been fixed, a contour map at a large scale is always constructed, showing enough spot elevation to permit the taking of cross-sections from the map for the individual alinements after they are finally located. Elevations of railroad tracks, existing pavement crown, and other critical points must be determined by field survey and preferably at the time the field control is effected for the mapping.

It is advantageous to have an accurate contour map of the area around a proposed bridge site. Final adjustments may be made of the channel location, borrow areas, etc., and usually these will eliminate sending a field party back for essential design data. These small-area maps for bridge sites are generally inexpensive, in that much of the field control work has been achieved by the field survey crew when the original alinement survey was made.

A contract has recently been awarded which includes a tri-level interchange. The terrain is very rough and was completely covered with trees, making it extremely difficult for the consulting engineer to compute the earthwork quantities. The completion date in the consultant's agreement was such that the information had to be procured during the summer months. He prepared a contour map of the area by field methods suitable for an estimate of quantities. After the contract was awarded the ground was cleared and the area photographed, and before-and-after cross-sections will be read from the stereo models. The final earthwork will be computed by the electronic computing machine.

Special Applications

Unusual uses for photogrammetry arise, such as a recent construction job along the Mississippi River, where it was desirable to determine the volume of muck removed for the fill. It would have been impossible to obtain the cross-sections by conventional methods until the material was frozen.

The Illinois Division of Highways has not awarded construction contracts for which the survey was predominantly accomplished photogrammetrically. Acceptance of aerial surveys will no doubt be delayed until contractors and construction engineers have gained actual experience with the new surveying techniques.

Results of aerial methods will in general be as good as, and perhaps even better than, those obtained through conventional surveys. Since photogrammetric control and critical measurements will necessarily continue to be made in the field, it is anticipated that the field surveyor will be with us for a long time to come.

The advantages realized by a combination of existing photography, medium-scale strip photography, small-scale photogrammetric mapping, and finally large-scale mapping, are many and diverse. As the location and design personnel become more familiar with the services that may be provided, the demands upon the Aerial Survey Section become greater and greater. Thirty-four people are employed in the Section and building construction is under way to more than double the present office space. No location or design work is attempted. The Aerial Survey Section personnel acquires information in the form of photography, prepares maps, obtains cross-section data, and drafts alinement and access control on mosaic negatives. The Photographic Laboratory furnishes reproduction service not heretofore readily available.

RESEARCH
ON HIGH RATE
Trickling Filter Efficiency

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IN SEWAGE treatment practices most widely used today the settleable solids are separated from the liquid and each is treated by different means. The liquid portion containing the dissolved and colloidally suspended solids is treated by one of two aerobic methods—the trickling filter or activated sludge process. The trickling filter is the more widely used of the two methods for small and medium size communities. This study deals with the effect of hydraulic loading and depth on filter performance.

The trickling filter was developed and used in sewage treatment in 1894 at Salford, England. In the ensuing years modifications and refinements have occurred, so that today it is accepted as a standard method for the secondary treatment of sewage (1). A considerable amount of research work relative to all phases of filter design and operation has been done. There are many divergent views as to the most practical filter depth and dosage rate, principally because conditions during the various investigations were standardized.

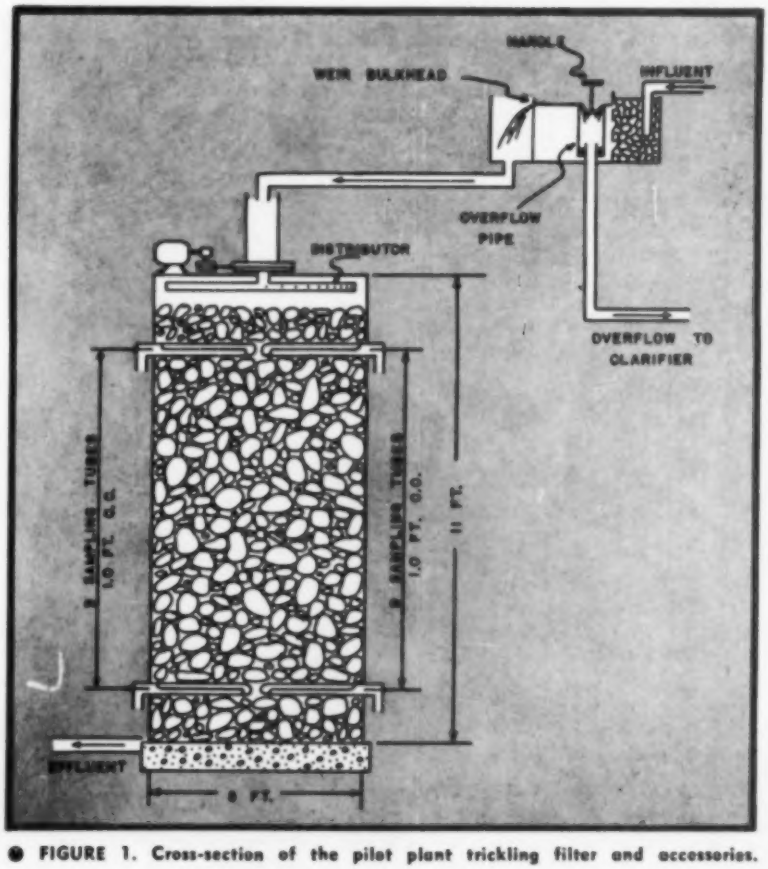
Studies sponsored by the National Research Council and conducted at a number of military installations indicated little or no correlation between hydraulic loading rates and the efficiency of the trickling filter and settling tank (2).

Keefer and Meisel have shown that increasing the hydraulic loading by 7-fold brought a decrease in the BOD removal efficiency by only 15 percent (3).

Keefer and Kratz indicated that the percent removal of the 5-day BOD remained constant within the range of 6.5 to 30 MGAD. They also conducted studies dosing 2-ft. and 4-ft. deep filters at the rate of 10 MGAD. The efficiency measured by the BOD removal was 47.5 percent with the 2-ft. deep filter, and 66.8 percent with a 4-ft. deep filter (4).

Much work has been done in Germany and in Israel relative to filter depth. In all cases the sewage being treated had a 5-day BOD of 100 to 200 mg/L as O_2, which was in excess of that commonly found in the United States. Popel, Rumpf, Rigibi and associates reported respectively that loading in terms of the BOD applied was as critical as the volumetric loadings (5, 6, 7). Popel's work indicated that, conditions being the same, a 19.68-ft. filter was twice as efficient in BOD removal as a filter 3.28 ft. deep.

The study reported here was carried out using a pilot plant trickling filter which was located at the Pullman Sewage Treatment Plant. A cross section is shown in Figure 1. The experimental unit may be divided into two components, the control box and the trickling filter.



● **FIGURE 1. Cross-section of the pilot plant trickling filter and accessories.**

Seasonal Variations of Trickling Filter Performance

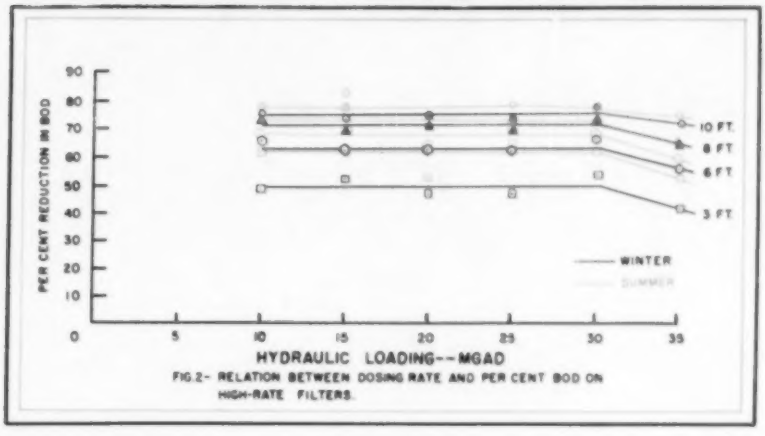


FIG. 2 - RELATION BETWEEN DOSING RATE AND PER CENT BOD ON HIGH-RATE FILTERS.

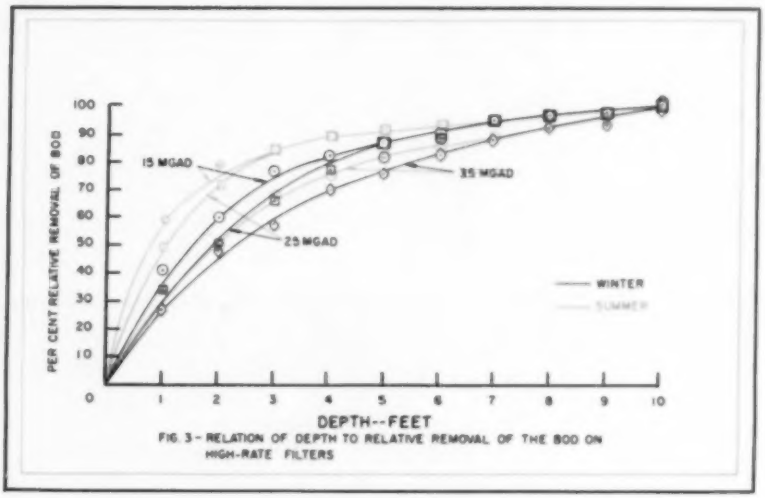


FIG. 3 - RELATION OF DEPTH TO RELATIVE REMOVAL OF THE BOD ON HIGH-RATE FILTERS

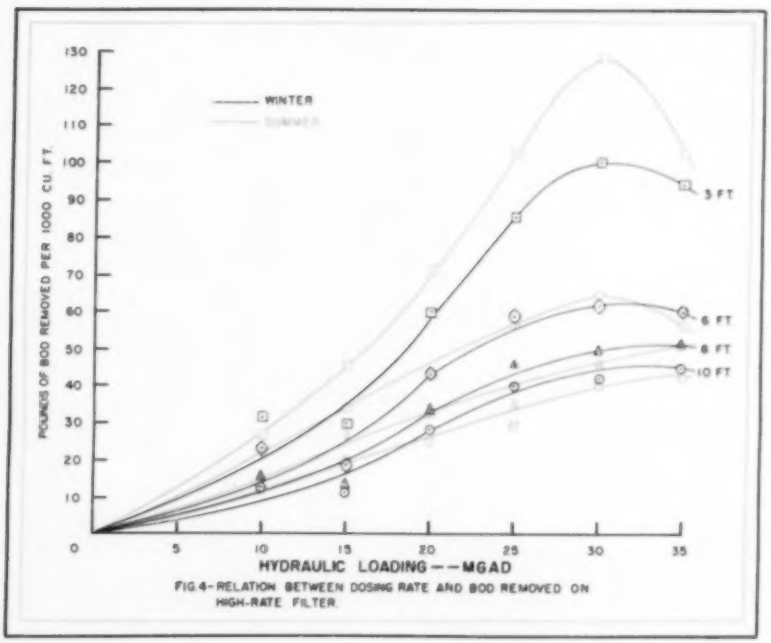


FIG. 4 - RELATION BETWEEN DOSING RATE AND BOD REMOVED ON HIGH-RATE FILTER.

Primary effluent was pumped into the control box, mounted on a 15-ft. tower. The flow out of the box was regulated by an adjustable overflow pipe. The sewage was allowed to flow over a 30° V-notch weir and measured by a hook gage and still well arrangement.

The shell of the filter was 11 ft. high, made of corrugated sheet metal having an effective diameter of 5 ft. and depth of 10 ft. The filter media rested on a 5.5-ft. square concrete slab which was sloped toward the center. A small channel in the base carried the filter effluent to a discharge pipe. A two-arm distributor was used to apply the sewage at loadings of 25 MGAD or less while a 4-arm distributor was used for loadings of 30 MGAD or greater. A quarter horsepower motor with a reduction gear assembly was used to rotate the distributors at a rate of 7.5 rpm.

Sampling tubes were placed at one-foot intervals starting one foot beneath the surface of the rock. The nine slotted sampling tubes extended to the center of their respective levels. The 10-foot sampling point was the filter discharge pipe.

The filter was dosed with effluent from the primary clarifier at the Pullman, Washington, Bio-Filter type sewage treatment plant. The feed consisted of raw settled sewage and recirculated primary filter effluent. During the study the recirculation ratio varied from 1:3 to 1:1.5.

The strength of the sewage as indicated by grab samples taken at time of filter sampling usually had a 5-day BOD of 100 ±20 mg/L O_2. The sewage applied to the filters was virtually all of a domestic type except for a slight amount of industrial wastes from a small dairy and a laundry.

Experimental Procedure

Growth on the filter rock was allowed to build up over a period of 30 days before sampling was initiated. Sampling of the influent and at all depths of the filter was done semi-weekly, the same day and approximately the same time. Sampling was done at about an hour after the morning peak flow had entered the plant.

The 5-day Biochemical Oxygen Demand was used to determine filter efficiency at the various depths. BOD determinations were made using the Alsterberg modification of the Winkler method, given in "Standard Methods" (8).

According to the "Ten States Standards" the accepted hydraulic

loading rate for a high rate trickling filter is from 10 to 30 million gallons per acre per day, and an applied 5-day BOD of at least 30 lb. per 1000 cubic feet per day (9).

The BOD loadings in terms of pounds of BOD applied per 1,000 cu. ft. of filter volume, in the investigation, amounted to 64 lbs. at the 10 MGAD rate, 96 pounds at 15 MGAD, etc. Rates to 35 MAGD were employed and filter depths of 3, 6, 8 and 10 ft. This gave a loading with 6 ft. depth one-half that of the 3-ft. depth; with an 8-ft. depth ¾ of the 3-ft. loading; and with a 10-ft. depth 0.3 that of the 3 ft. filter. This same ratio applied for all loadings. For instance at the 35 MGAD rate, loading for a 3 ft. depth was 223 lbs. per 1,000 cu. ft.; for a 6-ft. depth, 112 pounds; for 8-ft., 84 lbs.; and for 10-ft., 67 lbs.

Data and Discussion

Sampling was done semi-weekly at all the hydraulic loading rates investigated. The duration of the study period for a particular loading was a minimum of six weeks. After all the hydraulic loading rates selected for study had been investigated, the sampling scheme was repeated. Only data from summer and winter testing are presented in this article. The semi-weekly data obtained at specific hydraulic loading rates was condensed using statistical means to obtain single values for the respective depth. The data was graphed, the 5-day BOD vs. depth, using the curve of best fit method. The corrected 5-day BOD values in mg/L at various loadings and depths are presented in Table 1.

The 3, 6, 8, and 10 foot depths were investigated further. A graphical method used by Gillard was employed to obtain a reasonably conservative estimate of filter efficiency (10).

Fig. 2 illustrates the percent reduction in the 5-day BOD with respect to hydraulic loading at various filter depths during summer and winter. The percent reduction in the 5-day BOD does not change with increase in hydraulic loading in the 10 to 30 MGAD range at the respective depths and seasons.

A decrease in the percent reduction of the BOD did occur when the loading is increased beyond 30 MGAD. The rate of decrease between 30 and 35 MGAD for the 3 and 6-foot depths was the same, season having no effect. For depths greater than 6 ft., the rate of decrease was not as rapid. At the 10-foot depth there was only a slight difference in percent reduction in the BOD at the 30 and 35 MGAD loading rates.

Table 1—Corrected 5-day BOD at Various Depths

Summer: *Sampling Level*	*Hydraulic Loading, MGAD*					
	10	**15**	**20**	**20**	**25**	**35**
Influent	100	120	109	61	91	86
1′	57	63	84	30	52	65
2′	45	43	58	27	40	56
3′	38	36	53	22	33	46
4′	34	32	49	19	31	41
5′	33	30	46	18	30	37
6′	32	28	44	17	29	35
7′	29	27	41	17	26	33
8′	27	25	38	16	24	31
9′	24	23	36	15	21	29
10′	22	21	33	14	20	26
Winter:						
Influent	101	60	107	121	97	94
1′	75	43	84	94	67	74
2′	62	34	70	79	54	61
3′	52	29	60	68	45	52
4′	44	26	52	58	39	48
5′	39	24	46	50	35	44
6′	34	23	40	46	34	40
7′	31	22	36	42	32	37
8′	29	20	33	40	29	34
9′	27	19	32	39	27	31
10′	26	18	31	38	25	29
Summer average mean temperature (°F)	64	69.4	64.6	62.7	60.3	64.2
Winter average mean temperature (°F)	36.2	36.1	27.6	37.3	37.5	36.2

As shown by Figure 2, a greater degree of BOD reduction was obtained in summer than in winter at depths of 3 feet. Temperature differences due to season had little effect on the BOD reduction capability of filters which were deeper than 6 feet.

As the hydraulic loading increased, the quantity of food available for the filter flora and fauna increased. It would then be expected that the maximum removal of 5-day BOD would be obtained at the lowest hydraulic loading. The relative BOD removal capacity can be best illustrated by assuming the maximum removal of the 5-day BOD occurred at the 10-ft. depth. The relative removal of the BOD at a particular loading would be the ratio of the BOD removal at a specific level to that of the 10-foot level. The relative percent of removal of the BOD vs. filter depth curves for the 15, 25, 35 MGAD loading rates during summer and those during winter are shown in Fig. 3.

There was no difference in the relative removal of the BOD beyond the 2-foot depth between that for the 15 and that for 25 MGAD rates during summer. During winter the 25 MGAD loading rate curve intersected the 15 MGAD curve at the 5-foot depth. The 3 feet of additional depth required in winter can be attributed to the decrease in activity of the mesophilic microorganisms in the upper 2 feet. In the 15 to 25 MGAD loading range 50 percent of the relative removal occurred in the first 2 feet and 75 percent in the first 4 feet during winter according to Fig. 3. During summer operations 50 percent of the relative removal took place in the first foot and 75 percent in the first 2½ feet. As the depth increased beyond 6 feet the effect of depth and the average mean temperature to the rate of change of the relative percent of BOD removal decreased.

The 35 MGAD loading rate gave lower relative percent removal of the BOD at a given depth than did the 15-25 MGAD range regardless of season. Air temperature did not have as a pronounced effect on the relative removal capacity of the filter as first thought for 50 percent

(*Continued on page* 168)

CHANGING CONCEPTS of WATER FILTRATION

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THERE is now in progress a study by the American Water Works Association on filter design in relation to filter bottoms and filter media, as a primary feature of the overall process of water pretreatment and subsequent filtration. Out of this comprehensive study we may definitely anticipate specific recommendations for better processes and even entirely new methods affecting a long used system.

Concurrently with our increased need for better and more water we have a constant increment in the cost per thousand gallons of treated water, due to the upward spiral. These increased costs are forcing filter plant designers to look for every possible solution, so as to maintain filter plant expansion costs within the financial means of both small and large communities.

Diminishing sources of raw water in some parts of the country is forcing determined efforts to convert sea water, or brackish water having lower salt and mineral concentrations, to industrial and sanitary uses. Here again production costs resulting from current methods of conversion make such a source of supply prohibitive, except under conditions of dire necessity. If and when an economical process is discovered, we may find it readily applicable to our contemporary methods of water treatment when combined with present practices. However, until such a time, we must face the fact that we have either to operate present filter plants much more efficiently or build larger plant additions at compounding price increases.

What can we do to counteract this enormous increase in cost of filter plants which consultants, designers, contractors and initial buying agencies readily recognize, but which the taxable public apparently has not? First of all, it is the writer's opinion that we should make a determined effort to educate the public more thoroughly of the need for water treatment and also for treatment of sewage and wastes. Modern treatment procedure, bacterial control by chemical means and post chlorination can today assure a potable supply in almost any particular area in this country. Unfortunately a very small percentage of the public has sufficient knowledge to understand usual statements on water treatment. John Q. Public actually knows more about nuclear physics and intercontinental and planetary missiles than he does about the water which flows out of the faucets in his home. So why not take the wraps off of water and sewage treatment and let the public in on the "know-how"?

The hardest problem, however, is to convert the thinking in the water works field itself. We are still hamstrung by archaic concepts of water treatment formulated decades prior to our modern methods. Admittedly those concepts served for many years as a means of control, and the people responsible for the standards then established, can look back with justifiable pride upon an era in which a combination of progressive water treatment advances and increasing chemical treatment saw the eradication of all major forms of water borne communicable diseases. But we have now reached a place where both of these phases have reached an entirely new plateau in relation to the public. We can and should, begin to brief the public in non-technical phraseology as to the realistic status of water conditions in this country, and give the people some idea of the need for treatment and the cost thereof.

If we do not have an informed public we cannot expect favorable action voting or otherwise on bonds or plans involving expenditures of the very considerable sums of money needed for water works and sewerage improvements.

When are we, in the water works field, going to stop kidding ourselves and get down to the sources of the problem: the tax payer and consumer? We have a very good organization who has done wonderful work in the past and will continue to

(*Continued on page* 164)

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Analysis of a City Engineering Department Shows Broad Scope of Duties and Responsibilities

ROY W. MORSE,
Chairman Board of Public Works and City Engineer, Seattle, Washington

UNDER THE City Charter, Seattle's Board of Public Works consists of four members: Superintendent of Buildings; Superintendent of Lighting; Superintendent of Water; and City Engineer. The Board is empowered, and through it the individual board members, to manage and control the water and light and power systems; public buildings, public wharves, docks, bridges and viaducts; streets, sewers and public places and grounds, and all public utility facilities in the streets.

The Board takes public bids on all new construction work, the bids being read in open public meetings and the contracts subsequently being awarded to the low bidder. All street uses and occupancies are the direct responsibility of the Board, which issues permits for such requested uses when it is deemed compatible with the public interest. All meetings of the Board are open to the public and there are always members of the local press present to record such items as are of general reader interest.

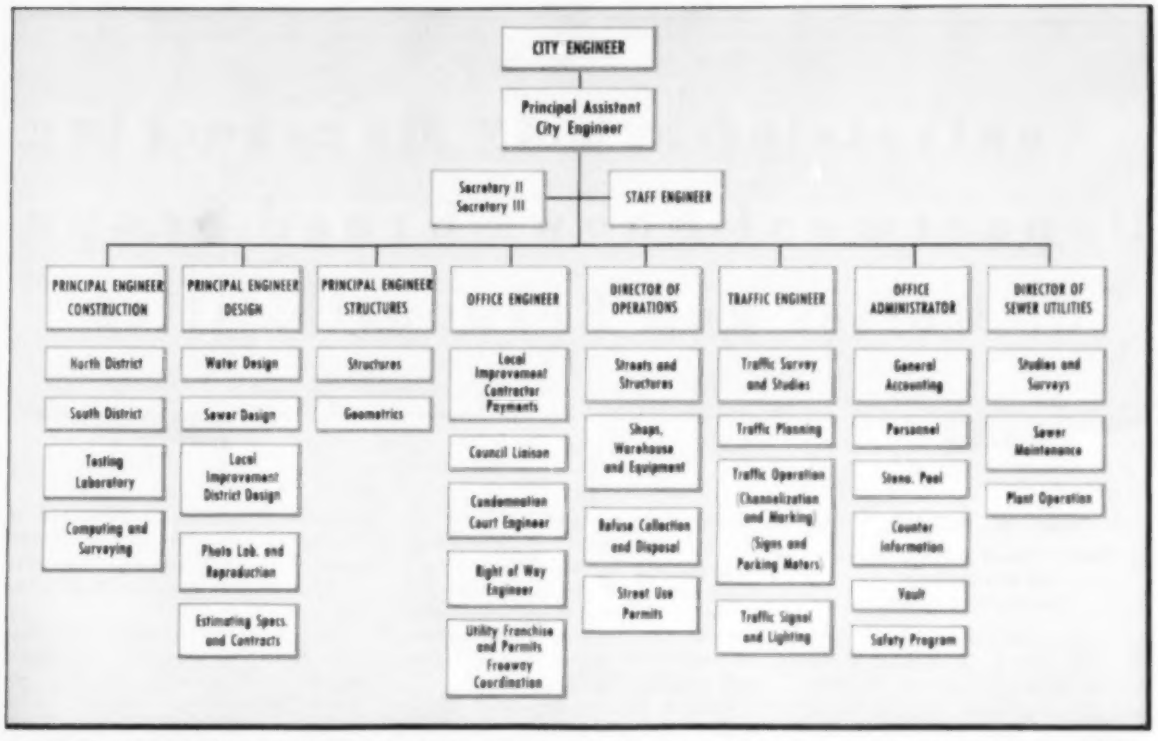
With a capable secretary and a staff of two, the office of the Board of Public Works is a most efficient operation in handling the annual $8,000,000 to $20,000,000 of new construction work and all of the myriad problems that come before the Board.

Administrative responsibility for the four main city departments is delegated to the four members of the Board. Each member of the Board is appointed to his particular responsibility by the Mayor, subject to confirmation by the City Council, for a term of four years. Seattle has been fortunate in the long service of its department heads and the members of the Board of Public Works are normally reappointed, thus becoming less susceptible to the vicissitudes of politics.

The author has learned that his principal post, as City Engineer, carries with it some corollary responsibilities. For instance, as a member of the City Planning Commission, the duties require attendance at weekly Commission meetings and quarterly hearings on rezonings. The Traffic Advisory Commission passes on matters of broad traffic policy and the author, as chairman, actively participates in the monthly meetings. Other continuing functions include membership on the official Urban Renewal Board, Regional Transportation Survey Committee, and the Civic Center Advisory Commission.

The successful operation of the Engineering Department, as described in the following paragraphs,

● **IN SEATTLE, the Board of Public Works manages and controls the water, light and power systems; public buildings, wharves, docks, bridges and viaducts; streets, sewers and public places and grounds; and all public utilities in the streets. Shown are J. Ray Heath, Superintendent of Water; Paul J. Raver, Superintendent of Lighting; the author, Roy W. Morse, City Engineer, chairman; Everett G. Henry, Executive Secretary of the board; and Fred B. McCoy, Superintendent of Buildings.**



● **ORGANIZATION CHART of Seattle's Engineering Department shows the wide variety of its duties and responsibilities.**

is largely dependent on the direction exercised by the capable staff of career civil servants. These people have demonstrated their abilities through competitive examinations and actual experience in posts of increasing responsibility. Their work, and the work of the dedicated people under them, is the force that keeps the Engineering Department in phase with its varied responsibilities.

Engineering Department

Quoting from the City Charter, "There shall be a department of engineering, the head of which shall be the city engineer. . . . It shall be his duty to make such surveys, maps, profiles, plans, specifications, estimates and reports as shall be required by the city; and, under the direction of the board of public works, to lay out, direct and supervise the construction of all public works within the city or on property belonging to, or controlled by the city, that may from time to time be ordered by the city council . . . .

"The city engineer shall, under the direction of the board, superintend and have the management and control of bridges, wharves, streets, gutters, sidewalks, sewers and drains of the city and the construction, repair, maintenance and cleaning thereof. He shall enforce all ordinances and rules of the board of public works relating to his department. He shall appoint under civil service rules, supervise and control all officers and employees in his department. He shall have such further powers, and shall perform such other duties as may be prescribed by ordinance, or directed by the board of public works."

These numerous and widespread responsibilities require eight major divisions with a total of 1125 people on the Engineering Department payroll. This averages out at 2.0 people per 1,000 population of Seattle's 578,000. This figure, while interesting, is not easily comparable with other cities of Seattle's population class as the author has found out in attempting to arrive at some "yardstick" of measurement. The areas of responsibility and activity, whether it be in a department of public works or a department of engineering, vary rather widely from city to city.

Construction Division

Except for the Traffic Division, this division has the greatest degree of contact with the public. It supervises all new construction work done by local improvement districts for water mains, street grading and paving, concrete sidewalks and sewers. It also supervises the building of arterials, trunk sewers, sewage treatment plants, water supply lines, reservoirs and dams. Important units in this division are the computing and surveying section and the testing laboratory.

The total value of improvements under contract in the year 1959 amounted to approximately $30,000,000. Whether it be the building of a $1,200 stairway on a hillside or the construction of a $25,000,000 water system, the almost 200 engineers in the Construction Division serve as the watchdogs of the city to guarantee top quality public work so that John Q. Citizen receives full return for moneys expended.

In the vanguard of engineering design and construction work, the Computing and Surveying section must accomplish all preliminary location and construction surveys for the department. In addition to this work, the mapping section prepares new maps from field survey data and keeps all map records up to date for the official city maps. These maps are prepared in quarter-section size and are currently being reduced photographically to one-half size for mounting in books for ready reference.

The Testing Laboratory is responsible for the quality of all ma-

terials used in new construction. In addition to maintaining constant control of the quality of Portland Cement concrete used in pavements and other public works, other building materials such as timber, structural steel, aluminum, fill materials, weld metal specimens, etc., are examined for fulfillment of specifications.

Special laboratory studies of the algae nutrients in the fresh-water lakes in and around Seattle are conducted from time to time to provide data for pollution control measures.

Design and Plans Division

This division makes preliminary engineering studies and reports and prepares construction plans, specifications and estimates for all engineering works. This includes water supply and distribution water mains, elevated tanks, chlorination and control works; sewers, sewage treatment plants and pumping plants; local improvement district projects, including grading for streets and sidewalks, paving of sidewalks, alleys and streets; and for street lighting.

A present design project involves the Tolt River Water Supply System. This $42,000,000 project will bring a second source of mountain water into the city of Seattle by gravity over an entirely different route than the present Cedar River supply lines.

The Tolt River supply system involves a storage dam on the south fork of the Tolt River. This calls for an earth-filled dam 200 feet above the bed of the river; clearing of the entire basin—a total of 1,090 acres; and the construction of a 36-inch supply transmission line to the north fork of the Tolt, at which point an equalizing reservoir will be developed by a small dam and a dike across a flat valley.

● **DESIGN & Plans Division includes Design Section, about one-third of which is shown here. Division prepares plans, specifications and estimates for all city work.**

At the equalizing reservoir will be built the chlorination works and control works, for the supply transmission lines leading to the city, a distance of 25 miles.

The first gravity transmission line of 90 mgd capacity from the Tolt is presently under construction and involves a 54, 60 and 66-inch diameter steel and concrete cylinder pipe furnishing water to a 60-million gallon concrete-lined receiving reservoir presently being designed on a hilltop north of Seattle. From the reservoir there will be built a series of transmission delivery lines to the distribution grid of the northern portion of the city.

A recent addition to the distribution system was the completion of Seattle's second two million gallon elevated storage tank.

All sewers constructed in Seattle prior to 1954 were designed for and functioned as combined storm and sanitary sewers. As the city prepares to participate with Metro (the Municipality of Metropolitan Seattle) in processing all sewage through primary treatment plants before discharge into the salt waters of Puget Sound, the Design and Plans Division must accomplish realistic storm relief designs. These are required to prevent the existing combined sewers from overflowing into fresh water Lake Washington and Lake Union during storm periods, and to reduce the cost of treatment. To do this economically is a challenge, for preliminary studies indicate an average cost, for storm relief lines only, of nearly $2,000 per acre. As several square miles of city are involved, careful evaluations must be made.

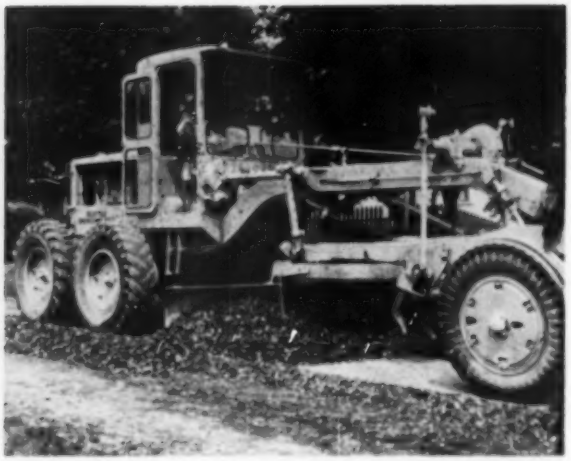
With six new sewage pumping plants already designed and in operation, this portion of the Design and Plans Division still has several more on its program.

● **CONSTRUCTION Division supervises all construction work—water, streets, sewerage, bridges, etc. Important units are Computing and Surveying and Laboratories.**

Structural Design Division

Preparation of structural designs and construction drawings for major

● **TRAFFIC Engineering Division has four major sections: Surveys, planning, operations and traffic signals and lights.**



● **MAINTENANCE & Operations Division responsibilities include street and bridge maintenance, street cleaning, refuse.**

bridges and traffic facilities comes under the Structural Design Division. This work requires frequent and constant coordination with the State Highway Department engineers, not only on the design problems, but also on the original geometric layouts of interchanges to fit new facilities into existing street patterns. In this connection close liaison is also maintained with our Traffic Engineering Division where traffic needs are continuously under study. Seattle, like other cities, has many special interest groups, and there has never yet been a proposed new traffic facility that didn't arouse vociferous groups, usually on both sides.

To assist in carrying the pressure of new public works, several firms of consulting engineers have from time to time been employed in recent years to provide services ranging from soils analysis to dam design. Our experience indicates that better results are obtained on those jobs that can be set apart as complete units, particularly structures.

Office Engineering Division

The Office Engineering Division consists of an Office Section, Assessing Section, Court Section, and Right-of-Way Section. The Division is responsible for liaison with the City Council; assisting the Law Department in processing of claims, law suits and condemnations; preparation of assessment rolls and maps for local improvement district projects; operation of a title abstract system for official city use; acquisition of right-of-way; and other matters as directed by the City Engineer.

The Assessing Section prepares assessment rolls and maps for an average of 30 different projects each year; it prepares many petitions for improvements under the local improvement district law; and it prepares petitions, sketches and reports on requests for vacation of streets and alleys.

The Abstract Section posts deeds, contracts and easements and checks probate and superior court cases to determine the disposition of property involved; prepares deeds and easements for property to be acquired for public streets and other municipal purposes; and reviews all new plats submitted to the Engineering Department for approval.

The Court Section prepares its own condemnation maps and assists the Corporation Counsel in major damage suits, and supplies information service to other departments and the general public on histories of past earth slides.

Right-of-Way Section major projects include acquisition of property for all public improvements handled by the Engineering Department.

Traffic Engineering Division

The Traffic Engineering Division, headed by two graduates of the Yale Bureau of Highway Traffic, currently employs 108 persons, which includes shop and field crews performing installations and maintenance of all traffic control devices. The Division comprises four major sections: traffic surveys and studies, traffic planning, traffic operations design, and traffic signals and lighting.

The Traffic Surveys and Studies Section has the responsibility of collecting, compiling, and analyzing traffic data in order that all functions of the Traffic Engineering Division may be performed on a factual basis.

All traffic accident reports in the city of Seattle are coded and processed by this section. Specific traffic accident information for engineering uses is readily available for every location in Seattle where there has been a reported accident.

A continuous program of traffic counting provides information relative to vehicular and pedestrian volumes at designated locations. Spot speed checks are made at numerous locations throughout the city and speed and delay studies are conducted on major arterial streets. Parking studies are made of both on and off-street parking conditions. Every request for the installation, removal, replacement or modification of any and all types of traffic control devices is investigated to determine warrant.

Traffic Planning and Design Section. A thorough knowledge of traffic operations is required in the planning and geometric design of new highway facilities. A liaison established between the City Engineering Department and the State Highway Department coordinates efforts in the solution of mutual transportation problems on the state highway system in the city.

Traffic Operations Design Section. The design, installation and maintenance of the 150,000 nonelectrical traffic control devices such as traffic signs, channelizing islands, pavement markings, safety fences, parking meters, etc., is the principal responsibility of this section. The 8,000 parking meters represent a major item in this group. Other duties include the establishment of detour routes and the review of street improvement plans. Approxi-

mately 20,000 gallons of paint are used for pavement markings yearly on over 350 miles of arterial streets. All of the traffic signs are painted and processed in the Traffic Engineering Division sign shop.

Traffic Signal and Lighting Section. The functions of this section include the design, installation, operation, and maintenance of all electrical traffic control equipment.

Traffic signal installations have been made at nearly 600 locations in Seattle, using over 1,500 traffic signal heads. Traffic-actuated signals are installed at 50 locations. The "delayed walk" type of control regulates the movement of pedestrians at 49 crosswalks in the central business district.

Traffic signal trouble crews are on duty 24 hours a day, seven days a week, performing routine and emergency maintenance work on all electrical control devices. Reports of malfunctions are given immediate attention.

Permits. Permits are issued for overlegal trucking operations, house moving, parking meter service hoods and special parking. Permits to construct commercial driveways are reviewed.

Office Administration Division

This division comprises all of the "supporting" sections such as general accounting, typing, personnel, vault for records, maps and surveys, and our safety program.

Since city employees are under civil service, it would appear that the need for personnel administration activities would be nominal in the Engineering Department. Even here, however, there is a certain amount of turnover and the department normally hires about 275 new employees each year. Selection is made carefully from lists of people who have successfully passed the civil service examinations. The new employee is placed in his or her work with in-service training as required. No formal training program is established, the responsibility here being placed with the supervisors.

Establishment of the annual Engineering Department budget and maintaining control through adequate accounting of the rather involved program requires the services of 24 employees under the direction of competent accountants.

Maintenance and Operations Division

Street and bridge maintenance and street cleaning activities include maintenance of viaducts, subways, seawalls and bulkheads; operation of the municipal asphalt plant; maintenance and operation of shops, warehouses, and equipment; supervision of the garbage collection and disposal contract; and issuance of side sewer and street use permits; and general regulation of use or occupation of street area.

Activities of this division are divided into three sections, with supervision and labor force as follows: The street maintenance section is Supervised by a General Supervisor of street maintenance and there are 500 employees; the sanitary operations section is supervised by a Supervisor of Sanitary Operations and employs 73 workers; the street use and permits section is under a Supervisor of Street Use and Permits and there are 31 men employed.

The Street Maintenance Section cleans, repairs and maintains all streets and surface drainage in 91 square miles of urban settlement. Street work is accomplished by five separately equipped districts where the foremen have close supervision of most activities in the district and shift personnel into different activities as required. This is supplemented by a city-wide heavy equipment pool and an all-craft "bulkhead crew," which operates under the foreman of the district to which they are assigned.

A 3,000-lb. batch asphalt plant, operating city-wide, produces 50,000 tons annually for resurfacing and maintenance. The districts assist in the maintenance of oiled roads.

Concrete repair crews, operating on a variable two-district basis, repair concrete street surfaces and backfill all utility cuts under pavements and all street building excavations in the business districts.

Over 100 bridges, including seven movable bridges, are operated and maintained on a city-wide basis. Viaducts, seawalls and tunnels are also under this section.

An outlying gravel pit is operated for road surfacing aggregate. King County assists in this operation by making a portable crushing plant available.

Cars and heavy equipment of the Engineering Department and nine other city departments are maintained and serviced through two shops and six service stations. The shops include a machine shop, metal fabricating shop, a blacksmith shop, a carpenter shop, a paint shop and a body shop. Considerable manufacture and alteration of specialized equipment are conducted by the City. The shop maintains warehouses and yards, procuring and disbursing a large portion of the equipment and supplies for the entire division. Emphasis on the work to be done shifts with the seasons and conditions. During rains, for instance, the needed portion of the street cleaning force may be shifted to sewer and drainage work. During snow and ice conditions, the entire force is shifted to control work and may be supplemented with rented equipment and extra help.

The flexibility of having the varied street and drainage activities under common supervision, though it demands versatile supervisors, has served the City well in permitting the maintenance and operation to be carried out with a smaller overall force.

The Sanitary Operations Section is responsible for the collection and disposal of garbage and rubbish. A single municipal contractor collects and disposes of all garbage within the city under the supervision of this section. All garbage collected is disposed of in rigidly controlled sanitary fills. In addition to the four sanitary fills, the division operates three public rubbish disposal sites for the use of homeowners and business concerns in disposing of material not normally collected by the garbage men. A total in excess of 1,200 tons per day is handled at these seven disposal sites.

A monitoring station for the National Air Sampling network, sampling for air pollution, is also operated by this section.

The Street Use and Permit Section, with 31 employees, is responsible for issuing street use and side sewer permits, handling all complaints regarding the permits,

● **TRANSIT is still an essential in municipal engineering work despite many electronic and aerial advances.**

street encroachments and drainage problems, complaints regarding street conditions, correspondence regarding these complaints, public contact through telephone and personal visits to the information counter, and maintains all records regarding these subjects. Street use and side sewer ordinances are enforced by this section.

Side sewer permits are issued over the counter to licensed contractors and homeowners. Licensed men must do all work in street areas. They receive their license after passing an oral examination given by the section head.

Field inspection sketches of side sewers are drawn to scale on sewer plats, and the information is transferred, to scale, to permanent file cards.

Side sewer backups during heavy rain storms cause additional work in this section. Each case is investigated and reported on to determine the cause, or remedy if any is available, and the facts are recorded early so that a claim for damages can be readily answered later. All such claims are referred to this office for report by the City Claim Agent.

The Engineering Department's Design Division and Maintenance foreman depend upon the records of the Street Use and Permit Section. Several relief sewers have been built as a result of these records, thereby reducing the number of claims.

Many street use permits require the posting of surety bonds, indemnity agreements or liability insurance to protect the City's interests and public facilities. The amount of the bonds and insurance are approved by the section head. Permits which need Board of Public Works' approval or a field inspection before issuance are separated from those which may be issued immediately by counter personnel.

Sewerage Utility Division

Principal responsibility of this recently organized division is the maintenance and operation of the four primary sewage treatment plants, plus a new 10 mgd modified activated sludge plant, 47 sewage pumping plants of assorted capacities ranging from 100 gpm to 42,000 gpm and the maintenance of 1100 miles of sewer laterals and trunks.

Studies and reports on sewerage problems and their solutions occupy a significant portion of the time of the division head and his assistants.

Safety Program

The prime responsibility for safety is that of the field supervisors, with full support from the executive staff. Accident prevention and the reduction of accident costs are as much a part of their jobs as labor, material and equipment.

A department safety supervisor, who is not a staff member but functions under the Administration Division, supervises this program and is in charge of the training program to make it operative through the foreman.

Basically, this safety program is directed toward vehicular safety, industrial safety, and first aid training.

Here's the nine-year record: In 1949, 204 vehicles travelled 1,224,000 miles and there were 108 recordable accidents; In 1949, 689 employees had 91 lost-time accidents with a frequency rate of 62.63; in 1958, 325 vehicles travelled 2,562,257 miles and there were 54 recordable accidents; and in 1958, 1,045 employees had 33 lost-time accidents with a frequency rate of 15.15. This program reflects slow but steady progress to eliminate accidents.

The author gratefully acknowledges that his several duties are made less burdensome through the leadership of Mayor Gordon S. Clinton and the active support of the members of the City Council. Seattle is proud that it represents a working example of the progress that can be made with effective teamwork in its executive, legislative and administrative departments.

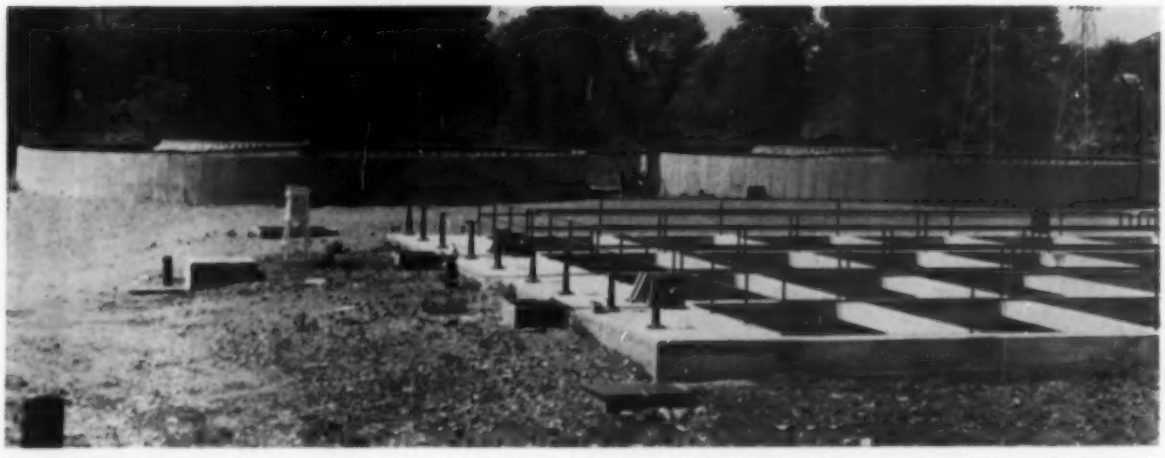
DESIGN OF A COMPACT TWO-STAGE SEWAGE TREATMENT PLANT

INCREASING population and the necessity to reduce the pollution load on the Ramapo River, were impelling factors in the decision by Suffern, N.Y., to construct a new sewage treatment plant. A few years ago, the Ford Motor Co. constructed a new assembly plant just across the river. As a result of this and other factors, population increased from 4,010 to 5,200 in six years; proposed additional developments indicated a still further growth. Accordingly a design basis of 12,000 population was assumed for 1976 by the Consulting Engineer, Olney Borden of Liberty, N.Y. Based on water use and other factors, the new plant was designed for a flow volume of 1.5 million gallons per day.

The existing primary treatment plant was overloaded and provided inadequate treatment. According to plant records, daily sewage flows ranged from 0.5 to 0.8 mgd. However, during heavy rains one of the pumping stations serving the plant normally overflowed, so no record of storm flow periods was available.

The plant as designed and constructed provides comminution, grit removal, primary settling, high-rate filtration, secondary settling, chlorination, sludge digestion and mechanical sludge dewatering with a vacuum filter. During ultra-high water periods, the river has risen to El. 275.0; since the area on which the plant had to be located is at or below this water level, special provisions had to be taken to insure operation during flood periods and to protect the plant against flood damage.

To provide this, the water level of the primary tanks was set at El. 276.0. The filters were placed on a slight gravel fill so that the outlet of the center channel was at El. 276.02; and the floor of the office and operating building was placed at 275.0. The pump room floor elevation is 271.0, with protection against flood inflow to about 276.00.



● **SEDIMENTATION basins. Near half are the secondary tanks, with primaries in rear. Filters are shown in the background.**

A Chicago Barminutor was installed at the entrance to the plant and this was followed by a grit removal equipment furnished by Link-Belt. After passage through a Parshall flume, with register in the plant office, the sewage flows to manhole A. This is the point where the incoming sewage is mixed with the recirculated flow from the primary filter and where supernatant from the digester, secondary sludge and filtrate from the vacuum filter are returned. Thence the flow is to a distribution manhole which feeds through cast iron pipes below the water surface to the twin primary tanks. Each tank is provided with two inlets.

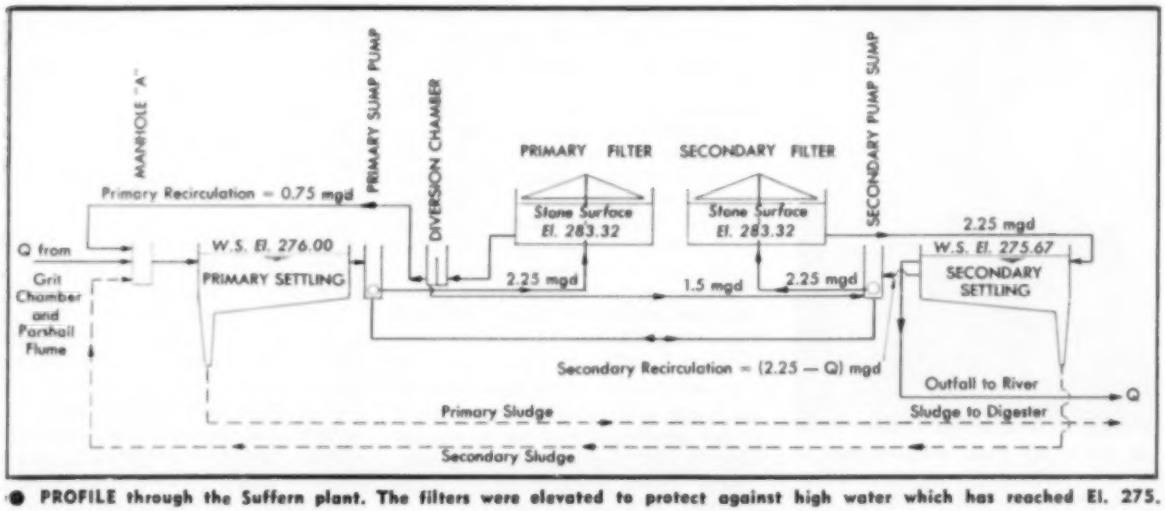
Primary and secondary tanks are identical in size, each consists of a pair of rectangular tanks 20 ft. wide, 80 feet long and with an average depth of about 8 ft. The pair of secondary tanks are designed so that the water level is 3 inches below that of the adjoining primary tanks. This was necessary because of the recirculation arrangement.

Both primary and secondary tanks are equipped with American Well Works sludge collectors. Multiple weirs of aluminum are provided to limit weir overflow rates. There are six of the serrated aluminum weirs in each tank, each 6 ft. long, providing 144 ft. of overflow. The rate on the primary tanks is 15,000 gpd per foot of weir and on the secondary 10,000 gpd The retention for the design flow is 2 hours in the primary tanks with an overflow rate of 700 gals. per day per square foot; and for the secondary tanks about 3 hours with an overflow rate of less than 500 gals.

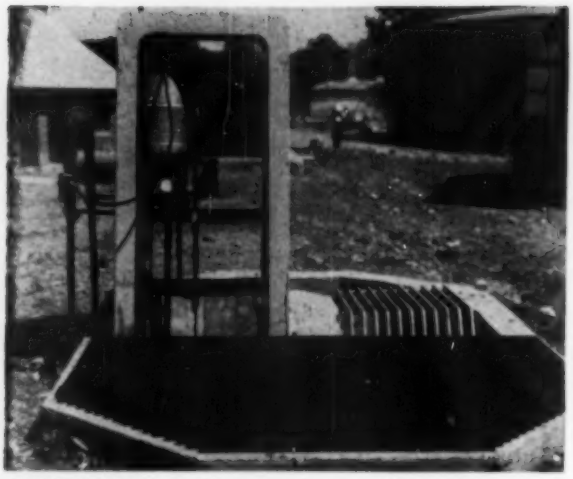
Trickling Filters

The trickling filters are of the biofilter type, and design is based on a loading of 1.00 pound per cubic yard of media. The depth is 5 ft.; underdrains are vitrified clay, TFFI specifications; distributors are 3-arm, American Well Works. Diameter is 70 ft.; both filters are identical in design and construction and the same type and size of media is used. Surface elevation is 283.82. Application to both filters is by pumping, which was necessitated by their location above flood level. The hydraulic load is 2.25 mgd, or about 25 mgad.

Recirculation to the primary tank is a constant 0.75 mgd, irrespective of the flow. The primary tank overflows to a small sump, 6 ft. square and about 8 ft. deep in which a propeller type pump is placed. This pump, with a capacity of 2.25 mgd doses the primary filter. The effluent from the filter flows to a weir chamber which has two weirs, one twice as long as the other. One-third of the primary filter effluent is returned to manhole A and two-thirds, or 1.5 mgd, flows to the secondary recirculating sump. In this sump, a 2.25 mgd pump feeds the secondary filter. The secondary



● **PROFILE through the Suffern plant. The filters were elevated to protect against high water which has reached El. 275.**

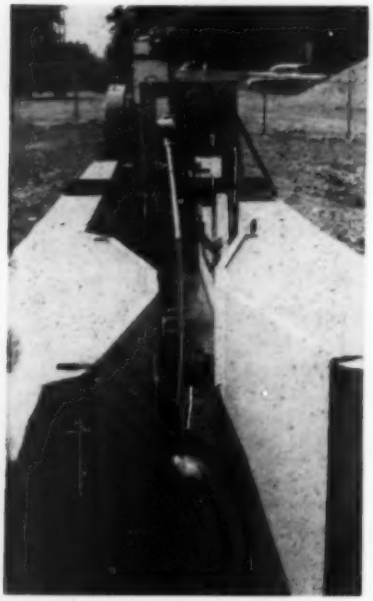


● **BARMINUTOR, with screen by-pass, foreground, showing grating to keep out stones thrown over the plant fencing.**

● **CLOSE-UP view of filters, showing application of sewage. Rate is about 25 mgad; filters are 70 ft. in diameter.**

sump is the same size as the primary and is connected to it by an opening at the bottom. It is also connected to the secondary settling tanks by means of a perforated pipe. This connection provides the 0.75 mgd which, added to the flow from the weir chamber, provides the loading for the secondary filter. The flow from the secondary filter passes to the secondary settling tank.

Power outages are not uncommon during severe storm periods. In case power fails, the raw sewage will receive primary settling and will then pass through the primary sump and the secondary sump into the secondary settling tank, thence over the weir and to the outfall line. When power is again available, the pumps must be restarted manually. With plants of this type, a short period—even a few days—without recirculation does not reduce materially the capacity of the filter to provide quickly a high degree of treatment.



● **PARSHALL flume measures flow of sewage. Indicator is in plant office. Grit removal equipment visible at rear.**

The chlorine contact tank has yet to be constructed. Pending its installation, chlorine is applied at the outlet end of the secondary settling tank. A Wallace & Tiernan chlorinator is used.

The two sludge pumps are arranged, by the use of 3-way plug valves, so that either can be utilized to pump either primary or secondary sludge to either manhole A or the digesters. Normal operation is for secondary sludge to manhole A and primary sludge to the digesters. A glass elbow is provided on each sludge line to permit visual observation of the sludge being pumped.

There are two digesters, each 45 ft. in diameter and 21 ft. sidewater depth. These are Dorr - Oliver equipped, with a central draft tube mixer on the primary and a floating cover on the secondary. Piping was simplified by the use of 3-way plug valves. The intermediate floor is of metal grating. The gas utilization equipment is in a separate building.

Sludge dewatering is with a Komline-Sanderson Coilfilter, 6 ft. x 8 ft., giving 150 sq. ft. of filter area. This is installed in an extension of the office and operating building, with an additional space where a truck can be backed up to receive the dewatered sludge by belt conveyor. Thus, there is no need for manual handling of sludge.

The office building provides, in addition to space for the sludge filter and the truck, an office, a laboratory, a lavatory and shower, a pump room and a chlorination room. The office, lavatory and laboratory are finished in tile. The building is of cinder block faced on the outside with brick.

Cost

The cost of the plant amounted to $492,929. This was distributed as follows: 21-inch vitrified clay sewer, 380 ft. at $15.60, $5,928; Barminutor, grit removal, flow meter, manholes and double check valve installation to protect the water supply, $25,450; settling tanks $121,000; digesters and related structures, $117,008; office and operating building with sludge pumping and filtration equipment, $125,900; recirculation sumps and diversion chamber, $9,990; trickling filters, complete, $46,480; pipe lines, $26,551; 1,021 feet of fencing with two gates, $4,708. All extra work totalled $9,914. A Public Health Service grant covered approximately 30 percent of the cost. The plant was placed in operation early in 1959.

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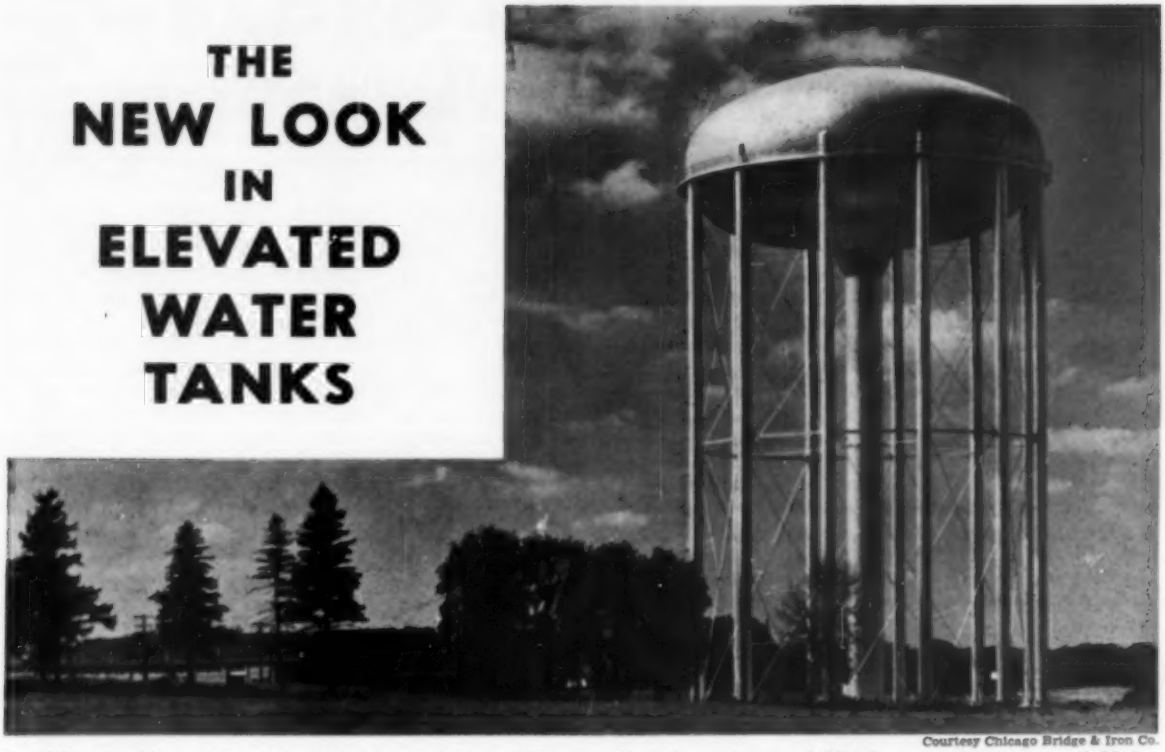
New Code Provides 14 Zones for Portland, Oregon

A new zoning code adopted by Portland, Ore., provides for 14 zones and, in addition, five special zones which can be added to the basic requirements to control such things as height of buildings and to regulate such matters as billboards. There are six residential zones, four commercial and four manufacturing.

THE NEW LOOK IN ELEVATED WATER TANKS



Courtesy Chicago Bridge & Iron Co.

● **THIS 1.5 million gallon spheroidal water tank serves Wheaton, Ill. It has a height of 130 ft. and a head range of 30 ft.**

ROBERT L. LAWRENCE,
Superintendent,
Water Department,
Alexandria, Louisiana

WITHIN the past twenty-five years a great change has taken place in the design of elevated tanks. In years past a tank looked like what it was—something to hold water with little or no thought to its secondary purpose of symbolizing the heart and life blood of the community; its aesthetic value was completely ignored. In spite of the ugliness, or perhaps because of it, the structure never failed to catch the eye of resident and visitor alike.

Gradually, because of decentralization of crowded districts and a migration of people to suburbia, distribution mains became stretched and it became necessary to bolster pressures and provide greater protection to areas now remote from the pumping station. This trend necessitated the invasion of residential areas with a structure that could no longer be ignored or only tolerated.

Aside from disliking the presence of naked steel columns and unsightly footings in the backyard, many homeowners were fearful of devaluation of their property. Public opinion presented the engineers and city fathers with a two-fold problem. Pressed on the one side with public reactions, creating difficulties in obtaining suitable sites, and on the other side with ever increasing need for elevated storage at the fringe areas, the planners began to look for a compromise solution.

One of the barriers in the way of design change was, at that time, the use of riveted seams which would not lend themselves to more graceful shapes and still provide the sound construction needed in such a structure. Welded seams, practically the only accepted type in today's design, were finally used in tank fabrication, and the resulting shapes were beyond anything possible in the past. A new concept of beauty and utility was born and has become, as well, a much sounder concept in hydraulics; also, definitely a more acceptable concept to the public.

It is certainly not the writer's purpose to recommend the replacement of all former style tanks. There is more than a possibility, however, that additional positive head storage will be required to meet the ever-increasing peak demand and average annual consumption with which most cities are now faced and for which most distribution systems were not designed. Fluctuating demands can no longer be met with pumps alone.

Once it is determined that elevated storage is needed a few organized steps in planning can be followed to provide the community with a happy end result from any perspective. The steps are to determine the purpose, the size, the location and the type and/or design.

Purpose and Size

The purpose of a proposed elevated tank will be dependent on existing and future conditions of the distribution system and planning should include a thorough study of the recommendations of the National Board of Fire Underwriters. Most water systems are becoming inadequate to meet the increasing demands of yard sprinkling, air conditioning and other uses by a society more water conscious than ever before. Such unexpected demands especially on peak days have caused communities to become more and more concerned with fire protection

This article is based on a paper presented at the Forty-first Texas Water and Sewage Works Association's Short School, College Station, Texas.

and what the meeting of Board requirements can mean to insurance rates. These factors, coupled with the greater volumes and pressures required in overly stretched distribution system, make it reasonable to assume that in order to satisfy the demand the purposes of storage will reasonably dictate the location.

The capacity of the tank will depend, of course, on what is needed to meet the above demands. These demands are an individual problem and require careful analysis and evaluation by competent engineers to determine future population trends, possible industrial development and a general coordination with existing facilities.

Operators have a tendency to "save" a full reservoir for fires and other emergencies at the expense of smooth pumping operations but if storage is adequate or will be made adequate and if the city is to realize the full benefit practically and financially, from elevated storage, 30 percent of available storage will be used to equalize production during peak demand periods (2). Since fire flow and peak demand storage are closely related, a study of each requirement separately and collectively is imperative to arrive at firm storage requirements. An estimate which can be used as a guide and has been determined as economical in some cities, is the supply of sixty percent of the peak hourly demand plus scheduled fire flow (3) from pumpage and the remaining forty percent peak demand plus fire flow from elevated storage.

Location

A proposed tank will prove most beneficial if the location is at the outer edges of the distribution system and opposite the pumping station. A study of the pressure plane in all directions and the required volume of water in any one location (high value districts and crowded residential areas) will indicate where the deficiency lies.

While considering height, it is well to remember that the Civil Aeronautics Authority has regulations concerning interference with airways and approachways by structures in excess of 150 ft. high. Although there are few tanks which surpass this maximum, it is always prudent to contact that agency to inform them of the elevation and location. Specific content of the ruling advises that any tank within twenty miles of a civil airway or within the approach areas of civil or military airfields must be approved prior to construction.

In the selection of a site, size is highly important. It must lend itself to ample room for maneuvering of equipment during erection and the storage of materials in such a manner as will not endanger the safety of workmen or give rise to costly damage suits which are difficult to avoid under any condition.

Even though a site location falls within a residential area, public acceptance is not impossible to obtain providing a positive approach and extensive and careful public relations prepare the way. Property is not necessarily devaluated nor aesthetics insulted, particularly because of present day designs. Once the location is accepted, the value to residents in service and protection will far outweigh the objectionable features.

Designs

Tank manufacturers of today provide a number of designs with protective coatings which enhance the tank appearance, so it is possible to provide a pleasing and distinctive badge for the system the structure represents.

There are five basic designs of steel elevated tanks: Double ellipsoidal, obloidal, toro-segmental bottom, radial cone bottom and the spheroid. With the exception of a slightly different volume of water within a given head range, and greater capacity available in some, the guiding factor in the selection is the whim of the owner.

A departure from the customary elevated tank design is that of prestressed concrete, one of which was recently completed at Tyler, Texas. It is of 2,000,000 gallons capacity and has an overall height of 195 feet. (5) The slip-form method of construction was used and the supporting structure consists of three concentric rings of concrete, the outer ring being fluted for aesthetic reasons. The tank itself is concrete with a floor two feet thick and an unsupported dome from eight inches thick at the circumference to four inches at the center. The design has formed an attractive monumental type structure within one of Tyler's many beautiful parks.

Beautiful and practical structures have been erected in all parts of the world, many of them defying old rules of convention. In 1937, Hickam Air Force Base, Hawaii erected an elevated tank which conformed to other base structures (6). The tank proper is of steel construction with a capacity of 530,000 gallons. It is completely encased in a concrete shell, primarily for the protection of the steel from the salt bearing air of the region. The tower is 171 feet high, octagonal in shape and surmounted by a dome-like cap giving an overall appearance of a campanile'. Three, ten-minute assaults by the Japanese in 1941 failed to do serious damage and the tower remained intact to conserve the area's critical water supply.

Alexandria, Louisiana erected in 1957 a radial cone bottom tank of 1,000,000 gallons capacity, with 138 feet to the overflow and a head range of twenty-five feet. It is dressed in four colors: white dome; ecru (tan) bottom, risers and columns; brown radial beams; and a light green catwalk railing. It is conspicuously located in a residential area and near a highway bypass route. Because of its location and striking appearance, many nice comments have been received from visitors. At night the upper portion of this tank is flood lighted at twelve-foot intervals around the catwalk railing. Reflected by the flat of the dome, an unusual but satisfying scalloped effect is achieved. There is no name or other lettering as it was feared that any such addition would tend to detract from the color scheme. Cost of the tank was $168,000 or about 17 cents per gallon.

References

1) *Ad Hoc* Committee Report. A.W.W.A. Public Information Program. *Jour. A.W.W.A.*, 50:4:453 (1958).
2) Aldrich, E. H. "Benefits of Steel Construction in Distribution Storage." *Jour. A.W.W.A.*, 47:6:57 (1955).
3) "Standard Schedule for Grading Cities and Towns of the United States" Natl. Board of Fire Underwriters, New York (1942).
4) Williams, Clyde E. "Finding Sites for Elevated Tanks." *Jour. A.W.W.A.*, 50:11:1433 (1958).
5) Fix, Robert E. "Texas Town Builds Giant Water Tank of Prestressed Concrete." *Water Works Engineering*, 3:10:937 (1958).
6) Moore, Charles. "Water Tank Conforms to Airfield Structure." PUBLIC WORKS, 90:2:148 (1959).

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Trimming Street Trees

In New Ulm, Minn., during the winter months employees of the Electric Department together with men from the Street Department undertook a program of tree trimming. Trees were trimmed not only to eliminate low hanging branches which interfered with motor vehicles but were trimmed to improve the street lighting. The work resulted in a radical improvement. This activity will be continued in the future to maintain control of these conditions.

WELDED WIRE FABRIC
IN HIGHWAY CONSTRUCTION

Two aspects of the use of welded wire fabric are presented in this article. The first, on reinforced concrete pavements, was prepared by Henry Aaron, former Chief of Airports Technical Branch, Civil Aeronautics Administration, now Chief Engineer, Reinforced Concrete Pavement Division, Wire Reinforcement Institute, Washington, D. C. Edward Howard, former Asphalt Institute engineer, now Field Engineer, Wire Reinforcement Institute, is author of the second portion, concerning asphaltic concrete overlays. The photographs, except as noted, are by Don Gehring, Wire Reinforcement Institute.

Developments in Reinforced Concrete Pavements

STEEL reinforcement of portland cement concrete pavements is now required for state highway construction in 30 states (including the District of Columbia). These states account for more than 75 percent of concrete pavements constructed by state highways departments. More striking is the fact that, of the approximately 2000 miles of concrete toll roads in operation or under construction, more than 95 percent contains distributed steel reinforcement.

Concrete pavements, since they are placed directly on the ground, are continually exposed to variations in temperature, moisture and soil movements as well as to traffic loadings. Under these conditions the slab bends, deflects, expands and contracts. As a result of these actions, together with the resistance to movement offered by the subgrade soil, the pavement cracks into slabs of variable length. Such cracks in a nonreinforced pavement are sources of progressive deterioration and breakage. With a properly designed network of distributed steel reinforcement breakage will not result.

● **HANDLING wire mesh reinforcing on the Ohio Turnpike, showing first concrete placed on the entire freeway. Pavement is 10-inch PCC with 78 lbs./100 sq.ft. mesh.**

Fundamentally, it is not the purpose of reinforcement in concrete pavements to prevent cracking completely, but rather to hold closely together all cracks that may develop, preventing slab separation and the progressive opening of cracks wherever they may occur. Reinforcement thus maintains the aggregate interlock so necessary for load transfer between the adjacent slabs.

Although the principal purpose served by reinforcing steel is to prevent progressive opening of cracks —and the slab is designed with this purpose in mind—the structural strength of the slab and, consequently, its ability to support traffic loads and resist other forces acting on it, is automatically increased. This is a natural result because the provision of load transfer results in reduced deflections and stresses. This behavior has been demonstrated by performance studies and field testing. Two examples will be discussed here:

Loading Tests in Michigan—In an attempt to investigate and evaluate the question of shear resistance at cracks, the Michigan State Highway Department measured relative deflections by loading cracks in existing pavements and were able to determine by actual test the percentage of load transfer developed by cracks in both plain and reinforced concrete pavements at various seasons of the year.

Loads were applied alternately on either side of the crack by means of jacks reacting against a rear axle of a truck loaded to 18,000 pounds. Measurements were made in summer and in winter. Results of these tests were reported in 1933.(1)[5]

Cracks in the reinforced pave-

ment were found to be shear resistant at all times. In contrast, the shear resisting capacity of cracks in the nonreinforced pavement was practically negligible except in the summer when cracks were more or less closed by expansion. The published report mentions that the plain pavement transferred 35 percent of the load in the summer but only 12 percent in the winter, whereas cracks in the reinforced pavement consistently transferred 48 percent of the load at all seasons of the year.

In view of these results the report recommends the use of closely distributed reinforcement and, in this respect, states "The fact that no free or semi-free edges would exist in this design of slab and that it would thereby be truly balanced both in a transverse and longitudinal direction, suggests the possibility of effecting a substantial reduction in thickness of cross section over that of plain non-interlock jointed pavement without the sacrifice of structural resistance."

Traffic Tests by Corps of Engineers—In 1957 Mellinger, Sale and Wathen reported the results of accelerated traffic tests on various thicknesses of reinforced and nonreinforced concrete pavements subjected to a load of 100,000 pounds on a dual wheel. They included in the report a chart showing the increase in effective thickness resulting from the use of different percentages of reinforcing steel. The chart reveals an appreciable increase in structural strength where the pavement is reinforced. Design curves, conservatively based on these data, are used by the Corps of Engineers for reducing pavement thickness when the slabs are reinforced.

Condition Surveys

Pavement condition surveys over the past 30 years have very definitely established the superior performance of reinforced concrete. Following World War II the Illinois Division of Highways conducted a condition survey of pavements on Route U. S. 66 which included reinforced pavements 9"-7"-9" in cross section and 22 feet wide constructed in 1938 and 1939 and nonreinforced pavements 10 inches thick by 24 feet wide built in 1942 and 1943. The nonreinforced pavements were constructed when steel was not available for pavements because of wartime restrictions.

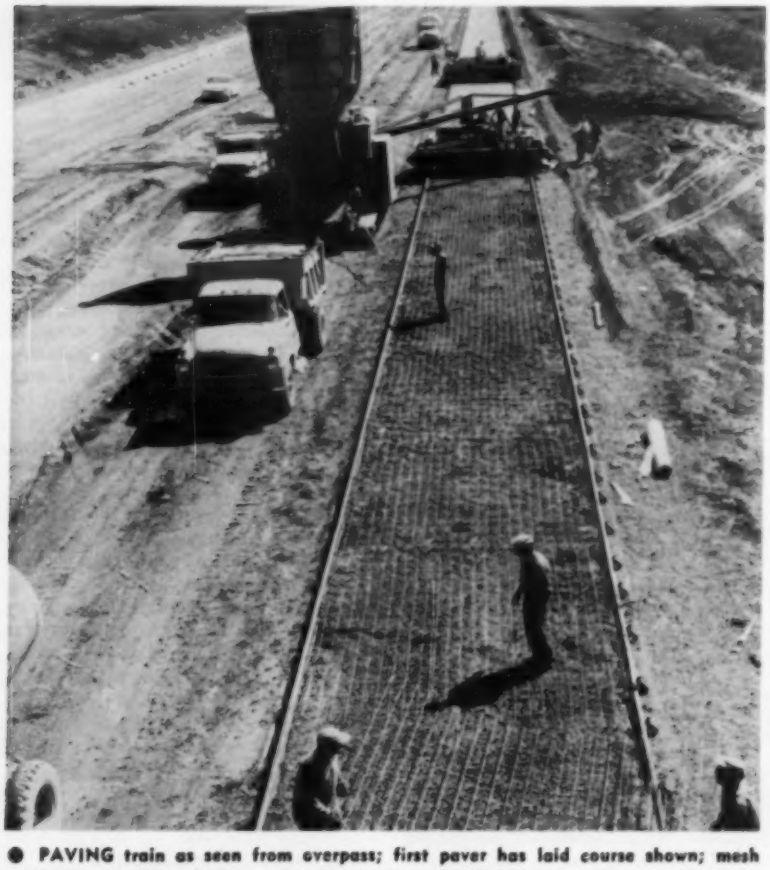
A preliminary report, prepared in 1951, states "The mesh reinforced pavements of this survey showed, except at a few locations, inconsequential separation of the slabs and no faulting at transverse cracks. Some faulting was noted at the joints, even though load transfer devices were provided. No structural failures were noted under normal subgrade conditions. Almost all joints and cracks of the wartime pavements showed slab separation and faulting. Separation was sufficient to keep aggregate interlock from effectively preventing permanent differential displacement of slab ends."

The report continued "Of most interest is the fact that the mesh pavements built prior to the emergency period, with a lighter cross section and in many cases on inferior subgrades, are performing better than the wartime pavements which have seen less service."

In November 1949, the Indiana Highway Department opened to traffic a 4-mile section of experimental concrete pavement to study the effectiveness of various types and thicknesses of subbase in the control of pumping of plain and reinforced concrete pavements constructed on fine grained soils. Since soil, climate, subbases, drainage, pavement thickness and traffic were identical for both types of pavement, the experimental section offers an excellent opportunity to compare the relative performance, under service conditions, of plain and reinforced concrete pavements.

In a report presented at the January, 1955, meeting of the Highway Research Board, the findings, as of December, 1953, revealed that the reinforced pavement was outperforming the nonreinforced pavement in all respects. Pumping and faulting at joints, evident in the nonreinforced pavements, did not occur in the reinforced slabs. Also, increase in pavement roughness was significantly less in the reinforced concrete.

An examination of the project in July, 1956, revealed that the conditions noted in the foregoing findings with respect to the non-reinforced pavement had become progressively worse. Instead of minor faulting at the joints in the plain concrete pavement on the natural subgrade, the faulting was so pronounced that it was difficult to control a car at the speeds permitted on the highway.



● **PAVING train as seen from overpass; first paver has laid course shown; mesh reinforcing in place. Batch truck, second mixer and finishers are shown at the rear.**

● **CONSTRUCTION in Canada—placing concrete on the Laurentian Autoroute; 6-inch concrete course shown will be followed by second 2-inch finishing course.**

There was noticeable faulting on all plain concrete sections but it was not so pronounced on the sections having crushed stone subbases. In contrast, faulting at the joints in the reinforced sections was negligible.

In spite of expensive subsealing (19.4 gallons of asphalt per hole drilled about 3 feet from each transverse joint in each lane) the faulting in the plain sections on natural subgrade became progressively worse and the cracked panels broke up further. The reinforced sections have not faulted; have good riding qualities; and the cracks are held tightly closed, requiring no maintenance.

Reinforcement Design

Reinforcement design for highway pavements is based on the well known "subgrade drag" formula which is expressed as

$$A_s = FLw/2f_s$$

where

A_s = area of steel required per ft. of width, sq. in.
F = coefficient of subgrade friction.
w = weight of slab in pounds per square foot.
f_s = allowable working stress in the steel, psi.

The coefficient of subgrade friction F is taken as an average of 1.5 for highway pavements; weight of slab averages 12.5 pounds per square foot per inch of thickness; and the allowable working stress f_s depends on the type and grade of steel. In this connection the American Concrete Institute recommends that f_s should be taken as two-thirds of the minimum yield point. In accordance with current ASTM specifications this would be 22,000 psi for structural grade of billet and axle steel; 27,000 psi for intermediate grade; 33,000 psi for hard grade and for rail steel; and 40,000 psi for cold drawn wire or welded wire fabric. In actual practice a working stress of 45,000 psi has been found satisfactory for wire fabric.

There are several other requirements that must be considered in design of pavements for highways:

a) Longitudinal wires should not be smaller than No. 2 gage and the spacing should not exceed 6 inches.

b) Transverse wires should not be smaller than No. 4 gage and the spacing should not exceed 12 inches.

c) Reinforcement should be placed a minimum of 2 inches and a maximum of 1/3 the slab thickness below the top of the pavement.

d) Steel should not extend through contraction or expansion joints but should be stopped clear of joint by not less than 2 inches and not more than 4 inches. The same clearances apply between the slab edges and extreme longitudinal wire.

e) Laps, where necessary, should be not less than the spacing of the wires; that is, for a 12-inch spacing the lap will be 12 inches.

Handling and Placing

Proper handling and placing of welded wire fabric will simplify paving operations and insure maximum production.

1) Slings should be used for loading and unloading sheets of welded wire fabric (usually handled with a crane) for delivery to the job site. Hooking a bundle of sheets at one point only may twist and distort the fabric so that it will be difficult to place properly.

2) Individual sheets of fabric should be distributed alongside the forms in advance of the mixer so as to be readily available for placement in the concrete. Within the past few years, several contractors have developed a trailer or wagon for the fabric which eliminates the need for advance distribution of the sheets, and reduces handling. The wagon, upon which may be stockpiled enough fabric for up to 2000 feet of pavement, is towed by the paving unit itself (often immediately behind the water tanker), or rides the forms immediately behind the first spreader to which it is attached. The sheets are pulled off the wagon as required, and placed directly onto the first course of concrete, using a minimum of manpower.

3) The first layer of concrete is spread and struck off with a mechanical spreader so that a layer of uniform thickness extends from form to form. The depth of strike-off is generally specified as a minimum of 2 inches and a maximum of 1/3 the design thickness of the slab.

4) Installation of the fabric can begin as soon as the first layer of concrete has been placed for a distance greater than the length of a sheet of fabric.

5) Sheets of fabric previously distributed along the side of the paving lane or carried on the truck are laid on top of the struck-off concrete. Specifications generally require that the extreme longitudinal wire be located a distance of not less than 2 inches nor more than 4 inches from the edges of the slab.

6) By means of end laps the fabric reinforcing is placed continuously between joints. The length of the end lap is usually equal to the spacing of transverse wires. An end lap is defined as the tip to tip distance between the ends of the longitudinal wires of the overlapping sheets. The steel does not extend through the contraction or expansion joints but, instead, is stopped clear of the transverse joint by not less than 2 inches and not more than 4 inches.

7) As soon as possible after the steel is in place, the second layer of concrete is deposited directly on the steel and spread mechanically in such a manner that the surface will be at the proper grade when consolidation and finishing are completed. Specifications require that the second layer must be placed within 20 minutes after the first layer has been struck off. In some specifications this is limited to 15 minutes.

8) Finishing operations are then performed in the usual manner.

Wire Reinforcing Institute photo.

● **RESURFACING project at Houston International Airport involved 9,000 feet of runways 150 ft. wide and 1,600 feet of taxiway 74 ft. wide. Note fabric placement.**

Developments in Reinforced Asphaltic Concrete Overlays

ENGINEERS have been attempting to find a satisfactory and economical solution of the problems of resurfacing worn rigid pavements; of repairing rutting and corduroying asphalt overlays at heavily traveled intersections and bus stops; and of holding an asphalt surface on a wood deck.

When planning or designing a reinforced asphaltic concrete overlay for a rigid pavement, the following factors should be carefully considered.

Types of Reinforcement — There are two types of fabric reinforcement—continuous and strip. Continuous reinforcement extends over the entire width and length of the pavement. Strip reinforcement is placed over the transverse joints or cracks, or over the longitudinal joints of a widened pavement, or both.

Continuous reinforcement should be used when the slabs have: 1) Numerous corner cracks as well as transverse cracks; 2) closely spaced transverse cracks between the usual joints; or 3) longitudinal cracks in combination with transverse cracks and joints.

Strip reinforcement should be used when: 1) The slabs are intact and the only breaks in slab continuity are the transverse joints; or 2) the slabs are in good condition except for occasional transverse cracks; or 3) a longitudinal joint is formed by the widening of the existing pavement.

If strip reinforcement should be required on both longitudinal and transverse cracks and joints, it may prove more economical to use continuous reinforcement. Conditions such as these should be analyzed on the merits of the situation.

Strip Reinforcement: For transverse joints the fabric should not be less than 8′-0″ in width. For longitudinal joints the fabric should not be less than 5′-0″ in width.

Continuous Reinforcement: The fabric should be 6 ins. narrower than the lane of asphaltic concrete being placed. The edge wires are placed 3 ins. inside the edge of the paving course.

Styles of Fabric: The most commonly used styles of fabric are 3x 6-10/10 and 4x4-10/10. These are furnished either in sheets or rolls and conform to AASHO Specifications, Designation M-55 and ASTM Designation A 185.

In style 3x6-10/10 the longitudinal wires (those parallel to the center line of pavement) are 3-in. spaced and the transverse wires (those at right angles to the center line of pavement) are 6-in. spaced. The gauge of the wires is No. 10 in both directions.

In style 4x4-10/10, the longitudinal wires are 4-in. spaced as are the transverse. The gauge of the wires is No. 10 in both directions.

Recommended Procedures

The welded wire fabric can be placed in one of the following positions: 1) Between the leveling course and the binder course; 2) between the binder course and the surface course. The thickness of the asphaltic concrete course covering the fabric should not be less than 1¾″ compacted.

Since corrosion is possible when welded wire fabric is placed directly on portland cement concrete pavement, it is recommended that a leveling course be applied to the rigid base in order to protect the wire against corrosion.

Regardless of whether strip or continuous reinforcement or sheets or rolls are used, the starting end of the fabric (the edge of the fabric nearest to the asphalt finishing machine) must be uniformly and firmly secured to the pavement. This is accomplished by driving concrete nails through the underlying asphalt course into the concrete pavement. The end transverse wire is then caught in back of the concrete nails. Another method used is the cartridge type of fastener. Either of these methods are successful and satisfactory.

Where these recommendations have been ignored and reliance has been placed on positioning the finishing machine or a truck on the end of the fabric the results have been completely unsuccessful and unsatisfactory.

Use of Sheets

Fabric furnished in sheets has been most commonly used due to the ease of shipping and handling. Since the sheets are shipped in bundles, the best way to handle and distribute them is to load the bundles on a flat-bed truck and pull the sheets off as needed. The sheets should never be tossed onto the roadside. The sheets can be placed well out in advance of the finishing machine, providing the truck drivers have been cautioned to drive carefully and avoid sudden starts or stops and turns when on the fabric.

The fabric recommended is style 3x6-10/10 or style 4x4-10/10. It must be borne in mind that for fabric of rectangular mesh opening such as 3″x6″, it is necessary to designate how the sheets are to be placed in order to determine width and length of sheets. Therefore, it is most desirable that drawings portraying the placement of the fabric be included in construction plans in order to prevent confusion in placing orders for the material.

The edge of the first sheet to be encountered by the finishing machine must be secured to the exist-

ing pavement. It is not necessary to secure the continuing sheets.

Although sheets have been placed by lapping them one space, shingle fashion, in the direction of placing the overlay, it has been found that better results have been obtained by simply butting the sheets.

Use of Rolls

Fabric can be furnished in rolls of any desired lengths, but for purposes of easy handling a length of 125 ft. to 150 ft. is suggested for full width rolls. Narrower rolls can be handled in longer lengths.

When rolls are used, the starting end of the fabric is secured to the pavement as previously described. The fabric is unrolled its full length with the transverse wires down. After unrolling the fabric it is held in place by a tensioning device consisting of a length of pipe and three pieces of chain which are attached to the pipe to form a bridle. By means of equally spaced J hooks the pipe is caught to the fabric. After applying sufficient tension manually to hold the fabric flat, the placement of the asphaltic concrete begins.

Usually several rolls are laid out at a time and are attached to one another by butting the end transverse wires and fastening them together by twisted wire fasteners or by wrapping the overhangs around the end transverse wires.

By joining several rolls in this manner, as much as 1000 to 1500 ft. may be laid out at a time on tangents. When curves are encountered, short lengths of rolls or sheets are used, depending on the sharpness of the curve. The long lengths of continuous reinforcement have but few joints and eliminate anchoring each roll at each end. However, the tensioning device must be used at all times.

As the equipment works over the fabric, a slight amount of bulging or waviness may develop in the fabric. This condition can be alleviated by crimping the wires. For this purpose, a crimping tool may be used. This consists of a length of pipe about 3 ft., notched at one end to fit over the wire (do not make the notch excessively wide) and with a handle on the other end.

Hold Down Attachment

In all cases of reinforced asphaltic concrete construction, a hold-down attachment on the finishing machine is imperative, regardless of the make of the finisher used. No other special equipment is needed.

The hold down attachment devised by the contractor must accomplish the following:

1) Keep the longitudinal edges of the fabric in place and prevent entanglement.

2) Keep any center bulges from becoming entangled underneath the finisher or with the spreader screw.

The most common type of hold-down device consists of runners on the outside of each "cat" track and a sled between the "cat" tracks. The outside runners are 5-in. channels 8′-0″ to 10′-0″ in length, turned up slightly at the forward end. The flanges are removed from the rear 3 ft. to leave a flat surface.

Each channel is secured to the front end of the finisher by chain or cable and located so that the rear end extends underneath the spreader screw, almost to the rear end of the spreader box, but forward of the screed and tamper. These channels must be secured to the side of the finisher in order to prevent lateral displacement. This is absolutely necessary as otherwise the rear end would spread out and go off of the fabric, thereby defeating the purpose for which intended.

The sled used between the "cat" tracks is made up of three 3-in. I's, cross braced with 2-in. angles or rods. The I's near the "cat" tracks should clear the tracks by not less than 6 ins. The middle I is centered. The front end of the I's should be turned up slightly like a sled runner. The rear 3 ft. of the top flange and web of the I's should be removed leaving only a flat surface. The positioning of the sled is the same as that of the outside runners, and should be secured against lateral displacement.

When constructing the cross bracing on the sled, rods are generally preferred, and are placed as high above the base as possible to prevent catching and dragging any material or refuse. The rear cross brace should be located far enough for-

● ON A straightaway, wire fabric may be placed in roll lengths, with tension device to remove slack. On curves, shorter lengths must be used and laid to fit curvature.

● CHANNEL with sled ends, suspended by chains, right foreground, helps keep fabric flat and away from feeder.

Table 1—Suggested Specifications

Standard Sieves 0/0 Pass.	Standard Sieves 0/0 Retaining	Bottom Course Min.	Bottom Course Max.	Surface Course Min.	Surface Course Max.
	7/8"		0		
7/8"	1/2"	30	50		0
1/2"	#4	15	30	25	40
#4	#10	5	15	15	25
#10	#20	2	8	4	12
#20	#40	4	10	6	16
#40	#80	4	10	6	16
#80	#200	2	6	4	10
#200		1	4	4	6
Bitumen		4½	5½	6	7

ward to be free of any spill over of the hot mix as it is fed into the spreader box, otherwise, the hot mix will build up on it and cause unnecessary drag.

When laying asphaltic concrete on a narrow fabric such that one edge of the fabric is outside the "cat" track and the other edge is beneath the finisher, the outside runner of the hold-down must be placed to ride at the edge of the fabric. If the sled of the hold-down is unsuited to ride the edge of the fabric beneath the finisher, it should be removed and replaced by a runner located so as to ride the edge of the fabric. It is quite possible that even two such runners might be required.

Coarse open graded asphaltic concrete mixes are not recommended for use with welded wire fabric reinforcement. Only dense graded mixes are recommended for such use. A good "rule of thumb" is that the maximum size of aggregate should not exceed one-fourth of the narrowest opening in the fabric. Suggested specifications are shown in Table I.

Special Applications

Welded wire fabric has been used very successfully to reinforce asphaltic concrete in such special locations as surfacing on wooden decks, at bus stops, at heavily traveled street intersections and on steel bridge decks.

Wooden Decks — Until welded wire fabric was incorporated as reinforcement of asphaltic concrete, it was impossible to retain an asphaltic concrete pavement on a wooden deck, pier, or bridge for any appreciable length of time, because it would shortly repeat the underlying crack pattern and begin to spall. Now, after the wooden decking has been repaired and secured, welded wire fabric, style 4x4-10/10 is placed upon it. The fabric is held in place by long staples driven into the decking, leaving the staple up about ½" to ¾". Asphaltic concrete, dense graded, is then spread over the fabric, shaped and rolled. If a finishing machine is to be used in spreading the hot-mix, the position of the "cat" tracks in the decking should be determined so that the stapling does not come underneath the tracks.

Bus Stops & Street Intersections —In order to prevent shoving and corduroying that occur at bus stops and street intersections, fabric style 3x6-10/10 is recommended. The fabric is placed upon a leveling course, the same construction procedures being followed as previously described, with this important exception: the 3" spaced wires are placed at right angles to center line of pavement, and the 6" spaced wires are placed parallel to the center line of pavement.

When a finishing machine is to be used, it is suggested that the location of the "cat" tracks be determined so that two or more rods, closely spaced, will support the finishing machine, and there will not be a bending or breaking of the wires.

The above information has been presented as a recommended practice for designing and constructing reinforced asphaltic concrete overlays, and is based on observations, studies, and performances of numerous installations during the past ten or more years. Continued research is being maintained and as new information is obtained it will be promptly distributed.

Bibliography

Reinforced Concrete Pavements:

1. A. C. Benkelman, "Tests of Aggregate Interlock at Joints and Cracks." *Engineering News-Record*, August 24, 1933.
2. F. M. Mellinger, J. P. Sale, T. R. Wathen, "Heavy Wheel Load Traffic on Concrete Airfield Pavements." *Proceedings 36th Annual Meeting of Highway Research Board*, 1957.
3. C. A. Hogentogler, "Economic Value of Reinforcement in Concrete Roads." *Proceedings 5th Annual Meeting of Highway Research Board*, Part II, 1926.
4. "U. S. Route 66 Condition Survey." Illinois Division of Highways, Research Project No. 2, Form LX-504, January 24, 1951.
5. W. T. Spencer, Harold Allen, P. C. Smith, "Report on Pavement Research Project in Indiana." *Highway Research Board Bulletin 116* 1956.
6. C. E. Vogelgesang and W. E. Teske, "Performance of an Experimental Project to Determine the Efficiency of Several Plain and Reinforced Concrete Pavements." *Highway Research Board Bulletin 165*, 1957.
7. *Recommended Practice for Design of Concrete Pavements*, (ACI 325-58).

Reinforced Asphaltic Concrete Overlays:

1. Bone, A. J. and L. W. Crump, and V. J. Roggeveen, "Control of Reflection Cracking in Bituminous Resurfacing over Old Cement Concrete Pavements." Reprinted from *Proceedings, 33rd Annual Meeting, Highway Research Board*, 1954.
2. Bone, A. J. and L. W. Crump, " Revere Resurfacing Project," "Progress Report No 1," "An Experiment in Control of Reflection Cracking in Bituminous Surfaces Over Concrete Pavement," June 1954, Limited Distribution.
3. Bone, A. J. and L. W. Crump, "A Review of Current Practices and Research in Controlling Reflection Cracking." Preprint of paper presented at the Highway Research Board Meeting, January 1955. Limited Distribution. To be published in Bulletin 123 of the Highway Research Board.
4. Crump, L. W. and A. J. Bone, "Condition Surveys of Bituminous Resurfacing over Concrete Pavements," Paper presented at the Highway Research Board Meeting, January, 1955. Limited Distribution. To be published in Bulletin 123 of the Highway Research Board.
5. Norman G. Smith, "Welded Wire Fabric Reinforcement in Bituminous Resurfacing." *Technical Bulletin 204*, ARBA.
6. John H. Swanberg "Experimental Installation of Welded Wire Fabric in Bituminous Pavements." *Technical Bulletin 207*, ARBA.
7. Floyd G. Wakefield, "The Practical and Laboratory Use of Wire Fabric in Bituminous Resurfacing at Willow Run Airport." Norman G. Smith, "Resume of Results of Welded Wire Fabric in Bituminous Surfaces." *Technical Bulletin 215*, ARBA.
8. Edward M. Howard, "Welded Wire Fabric Reinforcement of Asphaltic Concrete." Norman G. Smith, "Welded Wire Fabric in Bituminous Surfaces." *Technical Bulletin 226*, ARBA.
9. Edward M. Howard, "Welded Wire Fabric Reinforcement in Asphaltic Concrete Overlays." *Technical Bulletin 238*, ARBA.

● PREPARING a sign prior to refinishing. Note that scaffolding is supported on outer post mounted bracket and on the rack side of the truck body at left.

SIGN HIGHWAY MATERIALS and MAINTENANCE

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THE PAST nine years have seen the publication of several articles pertaining to the signing of the New Jersey Turnpike. These articles discussed the sign design, materials, placement and basic location of destinational signs with respect to major interchange points. In reviewing these articles a number of parallels are noted between the Turnpike design standards and those recently adopted for the interstate manual. These include the array of destinational signs with respect to the point of exit, standard 12-in. and 16-in. lower and upper case removable type message copy and dark green background color. In special problem areas overhead sign bridges utilizing internal illumination, external illumination or reflective copy of 18-in. lower case and 24-in. capitals are used.

The backbone of our roadway signing, however, is the side-of-the-road post-mounted sign. We presently have had eight full years of maintenance experience with these and are in a position to evaluate most of the more common fabricating materials used during the period, from the standpoint of durability, appearance, structural adequacy and ease and cost of maintenance.

● GORE mounted sign is of redwood lumber and has an area of 96 sq. ft. Though frequent knockdowns are likely with this type sign, large, legible sign is needed.

The highway signing engineer today is faced with almost a limitless list of fabrication materials, each of which has satisfactory service durability, good finished appearance, and adequate structural soundness. With particular reference to large sign construction (above 4 ft. by 8 ft.) there is relatively speaking, very little cost difference among the preponderance of materials available with respect to the total overall cost of the signs in place. So much of the cost is in the actual fabrication and erection of the sign that difference in cost of background material has a minimal influence on the total cost. As an illustration of this point, we recently contracted for the installation of four double face, medial mounted, internally illuminated signs constructed of aluminum with molded plastic faces. The in-place cost including supports, fixtures, lamps, etc. was under $5,000 while the cost of extending underground power a distance of approximately 2300 feet to illuminate the signs approached $15,000.

From our experience and needs, I view ease-of-maintenance as one of the most important material characteristics of a sign. The safe and successful operation of any high-speed, high-volume arterial highway is directly related to the signing of the facility. Thus it follows that, once the proper and necessary signing pattern has been installed, it becomes imperative that these guideposts be continually maintained without loss of use.

The typical side-of-the-road mounted sign is vulnerably located, and therefore frequently damaged

by an errant vehicle. We were fortunate that our initial selection of sign fabricating material has proven to be of exceptional durability as well as being unexcelled for its ease of field maintenance. This material is heart redwood. All of the original work involving nearly 500 signs varying in size from 16 to 240 square feet were constructed of 1 by 6 inch tongue and groove redwood. These signs constituted nearly 100 percent of the major regulatory, destinational and guide signing on the Turnpike.

Several distinctive geometric shapes were used for the several different basic types. Thus, all service facility signs are elliptical, exit ramp directional signs are trapezoidal, and through roadway directional signs are rectangular. Many of the latter group contain large semi-circular areas at the top or bottom center for the prominent display of the exit numerals. All were fabricated of redwood with a minimum of material waste.

Many highway signs are compromised during the design stages and are ultimately erected with inferior inter-line spacing, inter-letter spacing, and edge distance. The product of this compromise is a sign that lacks proper readability and yields an ineffective highway guidepost. Such signs frequently are the result of a desire to economize on the sign cost by holding to standard size panels. We found this completely unnecessary as the random length stock makes it just as economical to construct a fractional dimensioned sign as one with one or two-foot increments in height or width. In actual practice, however, the sign sizes are confined to increments of six inches. This simplifies the actual construction and allows for the convenient attachment of the reflective border which is readily available in standard multiples of six inches.

Routine Maintenance

The initial six years following the installation of our painted redwood signs were almost completely maintenance free, except for those units damaged in accidents. At this time the desirability of refurbishing the signs became evident as the daylight appearance had depreciated significantly. This was confined primarily to the fading of the painted surfaces. In some areas the enamel coating on the message copy was badly discolored or peeling due to its long exposure to corrosive atmospheres. This atmospheric condition exists in several of the highly industrialized areas approaching the northern end

● **PROTECTING** an expensive sign. A typical installation of protective guard rail. Where large and expensive signs are involved, guard rail is best possible investment.

of the Turnpike. Such dramatic failures were confined to these areas only and none was noted throughout the balance of the Turnpike.

In late 1957 the refinishing program was instituted with all of the work to be accomplished in the field without need of sign removal. Each was carefully inspected for structural or material failure and, where repairs were found necessary, they were completed prior to refinishing. The refinishing operation was handled by a four-man crew consisting of two carpenters and two painters. Temporary movable scaffolding was erected on the sign supports for ease of access and undoubtedly speeded up the refinishing. Where original paint film failure necessitated spot priming, this operation was completed prior to the removal of the message copy or reflective border. The face of the sign was then stripped and the finish coat was applied. When average drying conditions prevailed, it was possible to replace the message copy and border on the same day. When this was not possible, the replacement was completed on the following day. Except for unusual conditions, the sign was removed from service for no longer than eight hours.

One of the unique features of the entire operation was that all of the message copy was also renewed during the painting operation. A duplicate set of newly refinished cut out letters was withdrawn from stock prior to the stripping of the sign to be refinished. These renewed units were replaced and the salvaged units were returned to the paint shop for eventual reuse after refinishing. While in the shop, the reflector buttons are visually inspected for such failures as internal moisture, cracks, or surface abrasion. Although such failures are quite infrequent, it is desirable to replace the damaged elements as their reflective value when in this condition is very low. By far the major cause of failure may be directly traced to misuse or mishandling of the material and malicious mischief.

We have during the past two seasons completely refinished over 300 signs. This was accomplished with but one field crew totaling 4 men. The ease and minimal cost at which this project is being completed has convinced us that our initial choice of material was an excellent one.

Emergency Maintenance

The frequency at which side-of-the-road mounted signs are damaged by vehicles is surprisingly high. Probably the most vulnerable is the exit sign mounted in the gore between the through roadway and turnoff ramp. This is the natural target for the vehicle traveling at too high a speed to negotiate the bifurcation of the exit ramp. There are 49 such signs on the Turnpike, and the average number of knockdowns occurring per year is 16. About 6 of these result in complete destruction of the units requiring total replacement of the sign and posts. The remainder are repairable; two have to be rebuilt. Signs receiving minor damage (i.e. knocked off corners, broken posts, split battens, etc.) are most frequently field repaired. Damaged fascia boards are replaced with new ones which have been shop primed. The finish color coat is then field applied at the convenience of the painting crew.

Our total annual sign damage experience averages approximately 140 signs per year. This includes 80 of the smaller regulatory type (under 25 square feet) with the balance ranging in size up to 200 or more square feet.

It is generally acknowledged that a modern well designed and signed

highway will have a favorable safety record. The method of erection of a sign that guides, directs or informs the driver may, however, destroy the very individual it is intended to serve. Heavy metal mounting columns or posts, without adequate protection are as destructive to an errant motor vehicle and its occupants as an overhead bridge abutment or pier. Large steel I or H-beams which may be required to support vast sign areas against design wind loads are unyielding upon impact. Because of this we resort to the use of steel posts only on very large signs and then when the location is to be guard-rail protected.

Where large and expensive signs are involved, whether the posts are steel or wood, the installation of protective guard rail is undoubtedly the best possible investment. Guard rail costing $400 will adequately protect even the largest side-of-the-road mounted sign. It is not uncommon for a sign of these proportions to represent a total investment of ten or more times the value of the guard rail protection. Considering the dual advantages of a guard rail installation, it is not difficult to justify the additional monetary expenditure.

Other Signing Materials

We have used many of the other popular signing construction materials over the years. Each material has certain advantages for particular applications. An excellent example of this is a recent revision of our exterior illuminated overhead sign specification. All new units of this type are being constructed of porcelain on aluminum panels. Here again, the choice of the material was based on not only its excellent appearance but its durability and freedom from maintenance needs. An occasional washing is all that is required to keep it in A-1 condition, as the background color is permanently fused into the completely inert glass-like finish. To guarantee at least partially against obsolescence, removable type message copy and border is used in the event a revision might be required, an appropriate precaution in light of the dynamic characteristics of our ever-expanding highway network.

Ground mounted signs located in guard-rail protected areas have been constructed of the various types of plywood including the more recent plastic coated variety. Although our experience time-wise is less than half of that with redwood, this material when properly used should yield a satisfactory service life with a minimum of routine maintenance.

The technique of large sign construction using plywood differs from that of other materials. To reduce the possibility of moisture entering the panel edges, only vertical panel seams are permitted. Signs with large vertical dimensions exceeding the standard panel size can be constructed of special overlength panels available at a premium cost. Vertical panel edges must be sealed and painted prior to assembly. All external edges must also be sealed and be further protected by the addition of a snug-fitting aluminum U-channel which excludes water and prevents delamination if the moisture seal should fail. Signs constructed to these standards should have an exceptionally long life with little burden on the maintenance budget.

Our experience with aluminum panel sign construction has been confined to single panels or less except for the several overhead signs constructed of porcelain on aluminum previously mentioned. The durability of this material has been proven. The problems of damaged sign maintenance using this type of construction are nearly identical to those of plywood signs. Even minor damage requires single or multiple panel replacement. The ability of this material to deform without fracture may result in more extended sign damage than is warranted by impact.

Summary

There is no time like the present for traffic or highway signing engineers to review their signing program. The current Interstate highway construction program will add tens of thousands of signs within the next several years. The adopted sign design standards will require signs of enormous size, many of which will be far larger than any state hitherto has displayed. This aspect may well result in maintenance problems which will become a difficult economic burden to the department. Depending upon the chosen materials, special equipment and tools may be required to insure adequate and prompt maintenance. Workmen must be trained in accepted fabrication methods economically to produce replacement signs and to repair damaged units satisfactorily.

There is little doubt that the use of foresight and sound judgment in the design and specification stage will reap great economies during the future years. I feel confident that many others have experienced the same ease with which initial construction funds are made available, but also feel the continuing difficulty in securing adequate maintenance money. Safe highway operation requires good signing, and signs must be adequately maintained for full highway utilization.

● **TYPICAL small sign of redwood. A "35" MPH overlay sign for use under dangerous conditions is stored on the back.**

● **WORK of maintenance progresses on rear of sign while face is being prepared for paint coat. Sign erected in 1951.**

STRUCTURAL DESIGN OF CLAY PIPE SEWERS

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THERE are three major phases of sewer design; capacity, hydraulic and structural. Only the structural phase of sewer design will be covered in this article. Further information on design and proper sewer construction methods may be obtained from A.S.T.M. Specification Designation C-12-58T.

Loads placed on pipe in trenches may be classified as vertical and horizontal.

Vertical Loads

Vertical loads may be defined as normal or superficial. Normal loads are those caused by the earth cover over the pipe. Superficial loads when caused by piles of coal, gravel, etc., are known as long loads, that is, they are longer than the trench width; when caused by building foundations, traffic, etc., they are known as short loads, since the load is shorter than the trench width.

There are many types of trench load tables and graphs available in handbooks and other literature. Most of these are based on the work of Anson Marston and his associates of the Iowa State College who found that not only are trench loads affected by the volume and weight of backfill material, but also by the types of material due to their varying fractional qualities. For instance, clay, consisting of more or less flaky particles, tends to stack up, while sand spreads out. When such materials are placed in a trench over the pipe, the sandy material tends to spread out placing part of its weight on the trench walls, while the clay material tends to stack up, placing a greater portion of its weight on the pipe.

Trench width has an important part in sewer design. As the trench width increases, the load on the pipe increases due to the weight of the larger volume of material which it places on the pipe; and also due to the fact that as the trench walls widen, its frictional resistance supports less of the total backfill material. Steel (2) suggests a design trench width equal to 3/2 d + 12 inches, where d is the internal diameter of the pipe.

The depth of cover, which is the distance from the top of the pipe to the top of the ground, likewise affects the load on the pipe, in that it increases the total volume, and, therefore, weight of backfill over the pipe.

Marston (1) expressed the relationship of load to the above factors as follows:

$$W = C\ w\ B^2,$$

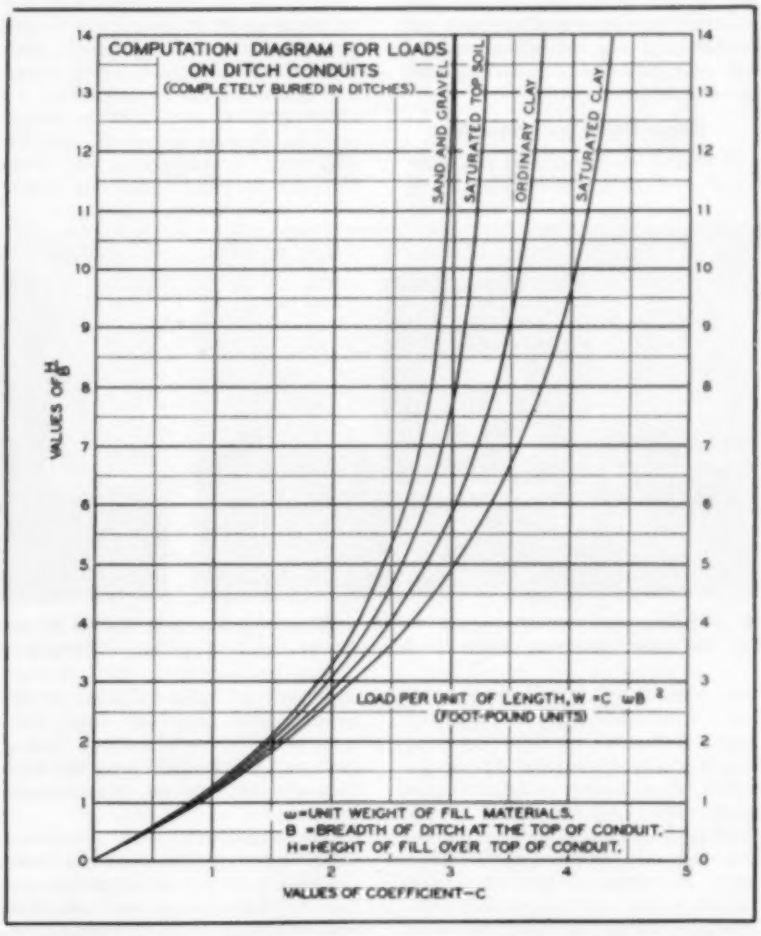
where:

W = The vertical external load on a closed conduit due to fill materials, pounds per foot;
C = Load coefficient depending upon type of backfill soil;
w = The unit weight of backfill material, pounds per cubic foot; and
B = Horizontal width of ditch at top of pipe in feet.

Values of C may be obtained from Fig. 1 for appropriate values of H/B and the type of soil encountered.

When the appropriate data are substituted in the above formula, the load on the pipe is obtained in terms of pounds per linear foot.* The actual weight of the backfill material should always be determined, as some soils, according to Steel (2),

*The loads for backfill depths to 30 ft. and trench widths to 9 ft. are available in tabular form and copies of the tables may be obtained from the author.


COMPUTATION DIAGRAM FOR LOADS ON DITCH CONDUITS
(COMPLETELY BURIED IN DITCHES)
SAND AND GRAVEL
SATURATED TOP SOIL
ORDINARY CLAY
SATURATED CLAY
VALUES OF H/B
LOAD PER UNIT OF LENGTH, W = C ωB²
(FOOT-POUND UNITS)
ω = UNIT WEIGHT OF FILL MATERIALS.
B = BREADTH OF DITCH AT THE TOP OF CONDUIT.
H = HEIGHT OF FILL OVER TOP OF CONDUIT.
VALUES OF COEFFICIENT—C

● **FIGURE 1. Computation diagram for loads on completely buried ditch conduits.**

weigh as much as 130 pounds per cubic foot. In dealing with soils of this weight, if the load design is based on 100-pound material, then a 30 percent overload will exist.

It is a relatively simple matter to obtain an accurate soil weight figure. This is done by excavating a one-foot cube of undisturbed soil with a hand trowel and weighing it.

Horizontal Loads. Plastic soils are soils which have a high coefficient of expansion when wetted. Horizontal loads caused by plastic soils can cause considerable damage to water and sewer conduits of all materials. Dawson (3) has measured forces caused by plastic soils up to 15 tons per square foot. More information concerning horizontal loads caused by plastic soils is needed and undoubtedly will be forthcoming in time, due to the destructive nature of such forces upon piling and foundations as well as conduits. However, enough is known about these forces at the present time to offset at least partially, their destructiveness.

Short Loads. Short loads, or live loads, caused by traffic are generally calculated as a percentage of the total applied or wheel load caused by the traffic. Table 1 "Percentage of Wheel Loads Transmitted to Underground Pipes," includes both the live load and impact transmitted to the pipe.

Long Loads. Pipe loads caused by long loads such as piles of coal, gravel, timber, etc., which rest on the surface of the backfill material in the trench, may be determined by the formula,

$$W_1 = C_2 BP_1,$$

where:

W_1 = load on pipe in lbs. per lin. ft.
C_2 = coefficient
B = width of trench at top of pipe, in ft.
P_1 = super load, in lbs. per sq. ft.

Hardenbergh (4) lists the values of the coefficient, C_2 for long loads. These are shown in Table 2.

Strength of the Pipe

The total supporting strength of a pipe installation is equal to the sums of the strength of the pipe itself and the strength added by the method of embedment (foundation).

Pipe Strengths. Clay pipe is purchased under A.S.T.M. Designation C-13 for standard strength pipe and C-200 for extra strength pipe. These specifications for standard and extra strength clay sewer pipe are set forth in Table 3 and Table 4. The two common methods for testing clay pipe are (1) three-edge-bearing and (2) sand-bearing. Pipe tested by the sand-bearing method will test about 50 percent greater than when tested by the three-edge-bearing method. However, the three-edge-bearing method is now used almost universally due to its comparative simplicity, convenience and speed. The results of pipe tests are stated in pounds per linear foot, and must be at least equal to the values shown in Tables 3 and 4.

Table 1 — Wheel Loads Transmitted to Underground Pipes
Percent of Live Load and Impact Applied per Linear Foot of Pipe

Depth of Backfill Over Pipe, Ft.	Trench Width at Top of Pipe in Feet						
	1	2	3	4	5	6	7
1	17.0	26.0	28.6	29.7	29.9	30.2	30.3
2	8.3	14.2	18.3	20.7	21.8	22.7	23.0
3	4.3	8.3	11.3	13.5	14.8	15.8	16.7
4	2.5	5.2	7.2	9.0	10.3	11.5	12.3
5	1.7	3.3	5.0	6.3	7.3	8.3	9.0
6	1.0	2.3	3.7	4.7	5.5	6.2	7.0

From Clay Pipe Engineering Manual, Clay Products Association, Barrington, Illinois.

Table 2 — Approximate Safe Values of Coefficient C_2 For Long Super Loads on Pipes in Trenches

H / B	Sand or Damp Top Soil	Saturated Top Soil	Damp Yellow Clay	Saturated Yellow Clay
0.0	1.00	1.00	1.00	1.00
0.5	0.85	0.86	0.88	0.89
1.0	0.72	0.75	0.77	0.80
1.5	0.61	0.64	0.67	0.72
2.0	0.52	0.55	0.59	0.64
2.5	0.44	0.48	0.52	0.57
3.0	0.37	0.41	0.45	0.51
4.0	0.27	0.31	0.35	0.41
5.0	0.19	0.23	0.27	0.33
6.0	0.14	0.17	0.20	0.26
8.0	0.07	0.09	0.12	0.17
10.0	0.04	0.05	0.07	0.11

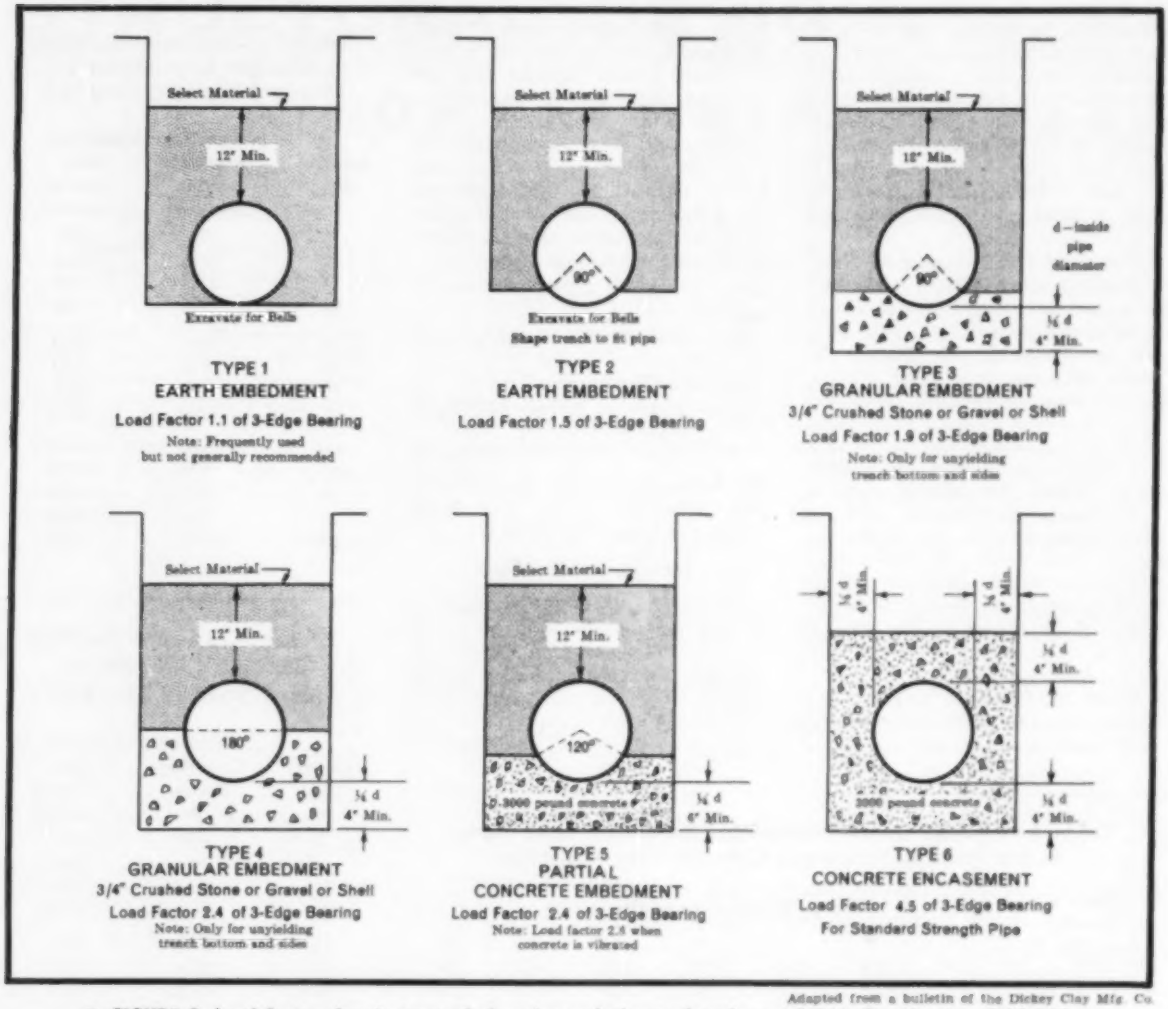
From Sewerage and Sewage Treatment, W. A. Hardenbergh, International Textbook Company.

Table 3 — Minimum Crushing Strength Requirements Standard Strength Clay Pipe

Nominal Size, In.	Pounds per Linear Foot: Three-Edge Bearing Method	Pounds per Linear Foot: Sand Bearing Method
4	1000	1500
6	1100	1650
8	1300	1950
10	1400	2100
12	1500	2250
15	1750	2625
18	2000	3000
21	2200	3300
24	2400	3600
27	2750	4125
30	3200	4800
33	3500	5250
36	3900	5850

Table 4 — Average Crushing Strength Requirements Extra Strength Clay Pipe

Nominal Size, In.	Pounds per Linear Foot: Three-Edge Bearing Method	Pounds per Linear Foot: Sand Bearing Method
6	2000	3000
8	2000	3000
10	2000	3000
12	2250	3375
15	2750	4125
18	3300	4950
21	3850	5775
24	4400	6600
27	4700	7050
30	5000	7500
33	5500	8250
36	6000	9000



Adapted from a bulletin of the Dickey Clay Mfg. Co.

● **FIGURE 2. Load factors for six types of clay pipe embedment, based on A.S.T.M. Specification C-12-58T.**

Since a pipe fails by elongation with the diameter in line with the force decreasing and with the diameter at right angles to the force increasing, any type of foundation or embedment which tends to restrain these changes in the pipe diameter will prevent the pipe from failing in proportion to the degree of restraint offered. Many types of embedment which tend to restrain elongation have been advocated over the years. Some of them are, of course, better than others. Most can, however, be classified as either a type of earth embedment, granular embedment or concrete embedment. Six types of embedment are shown in Figure 2. Types 1 and 2 are earth embedment; Types 3 and 4 are granular embedment; and Types 5 and 6 are types of concrete embedment.

Earth Embedment. Type 1 embedment is probably used more than all other types. Its advantage lies in its simplicity of construction. However, it has the lowest load factor of the various types of embedment shown in Figure 2 and therefore offers the least additional supporting strength of any of the types of embedment shown. It is probably for this reason that this type of embedment has often been designated as "impermissible".

Type 2 embedment has a load factor of 1.5, and calls for shaping the trench to fit the bottom quadrant of the pipe; however, some soils cannot be readily shaped. Even where soils lend themselves to shaping, the contractor often prefers going to another type of embedment because of the expense of shaping the trench by hand labor.

Granular Embedment. Granular materials may be used for the following reasons: 1) To obtain additional supporting strength; 2) to obtain a better foundation and working trench bottom; and 3) to offset the effect of plastic soils (by total encasement). Granular materials should have a particle size large enough so that there will not be a loss of material through a possible present or future faulty joint. Granular material embedments lend additional supporting strength to a sewer installation only when the trench bottom and walls which come in contact with the granular materials are non-yielding. Little or no additional supporting strength can be expected by the use of granular materials where the trench bottom and walls are soft. However, it is often advantageous to use granular materials for the other two reasons mentioned above. Seashell is not a true granular material, but it is often used for this purpose. However, it should be thoroughly compacted in the trench to prevent settling.

Type 3 embedment has a load factor of 1.9, and when additional supporting strength is desired, the granular material may be brought

to the spring-line or center of the pipe as shown in Type 4.

Concrete Embedment. Concrete embedment is probably the best type of embedment available. The compressive strength of concrete embedments vary from 2000 to 3000 psi 28-day compressive strength. The concrete should always be allowed to develop sufficient strength before back-filling. Concrete embedment is especially well suited for unstable trench conditions as in quicksand.

The embedment is often reinforced, forming a running beam which prevents differential settlement, has a load factor of 2.4 under by various types of piling when necessary.

Type 5, partial concrete embedment, has a load factor of 2.4 under ordinary conditions, but when the concrete is vibrated, a load factor of 2.8 will be developed.

Type 6, concrete encasement, has a load factor of 4.5. This load factor applies only to standard strength pipe. Where it is desired to use this type of embedment with extra strength pipe, the designer should refer to a handbook with tables of supporting strengths, such as the "Clay Pipe Engineering Manual," published by the Clay Products Association, Barrington, Illinois.

Load Factor. Each type of embedment in Fig. 1 shows the load factor, which indicates the additional supporting strength given to pipe by this method of embedment; for example, a 12-in. pipe which has a supporting strength of 1500 lbs. per linear foot when tested by the three-edge-bearing method, multiplied by the load factor 1.1, Type 1 embedment, equals 1650 lbs. per linear foot. This is the supporting strength of 12-in. pipe when installed according to the Type 1 embedment method. If greater supporting strength is needed, either extra strength pipe or one of the other types of embedment may be used.

Safety Factor. A safety factor should always be used in structural sewer design. A factor of 1.5 is generally recommended by most authorities. It may be incorporated into the design by either multiplying the load by the safety factor or by dividing the total supporting strength by the safety factor (the three-edge-bearing strength shown in Tables 3 and 4 multiplied by the load factor, gives the total supporting strength). For instance in the above example, 12-in. pipe has a supporting strength of 1500 lbs. per linear foot (three-edge-bearing test method); multiply this by the load factor of 1.1 (Type 1 embedment, Figure 2). This gives a total supporting strength of 1650 lbs. per linear foot which, when divided by 1.5 safety factor, equals 1100 lbs. per linear foot. This is the safety-factor-corrected total supporting strength of the pipe, when installed by the Type 1 embedment method.

References

1. Marston, A., *Bulletin 47*, Engineering Experiment Station, Ames, Iowa, Vol. XIV, No. 19, 1917.
2. Steel, Ernest W., *Water Supply and Sewerage*, McGraw-Hill Book Company, 1938.
3. Dawson, Raymond F., Unpublished Paper, "Foundations on Swelling Clays", presented before The American Society of Civil Engineers, Lubbock, Texas, April, 1957.
4. Hardenbergh, W. A., *Sewerage and Sewage Treatment*, International Textbook Company, Third Edition, 1950.

CONTRACT SEWER CLEANING SOLVES TROUBLESOME LOCAL PROBLEM

BY CONTRACTING with a firm of pipecleaning specialists to rehabilitate its badly-clogged trunk sewers, the Borough of Turtle Creek, Pa., just outside Pittsburgh, is eliminating a chronic and serious flooding problem, quicker and at less cost than would be possible with its own forces.

Turtle Creek's sewers are being restored by Robinson Pipe Cleaning Company, Canonsburg, Pa., a firm which employs modern equipment and highly-trained personnel for the job. The first stage in the project—involving some 3,000 ft. of 8, 10, 12, 18 and 36-in. sewer—was completed early in the spring of 1959. Additional sections are now being cleaned.

The Borough's sewer system was laid about 70 years ago. This is the first time the lines have ever been thoroughly cleaned. As in many communities, previous efforts were restricted to removing specific blockages when they caused trouble.

The 3,000 ft. of sewer line cleaned so far included the most trouble-some sections in the entire system. Even in dry weather, manholes were often filled with up to five feet of standing water. About half the users in the areas served by these sewers reported surcharges every time an appreciable amount of rain fell. In some basements, water collected to a depth of six inches. During a heavy rain, flows backed up through manholes and covered streets and parkways. Sewer gas and "sewer smell" made the problem even worse. Whenever there was even moderate rainfall, Turtle Creek's four-man maintenance crew was usually engaged fulltime for several days handling service calls. Often, overtime was necessary to take care of the work.

Since cleaning, there have been a number of rain storms in Turtle Creek, including one with a precipitation of about 2 in. of water in less than an hour. "In those areas served by the cleaned trunk sewers, we haven't had one case of flooding," reports Street Commissioner William Curran.

At the time cleaning crews moved in, the sewer system was an extremely sensitive subject in Turtle Creek. Angry residents appeared at nearly every meeting of the borough council and demanded action. Whenever there was rain, the complaints would increase in volume and intensity.

The magnitude of the problem is shown most dramatically, perhaps, by the amount of material removed. In one section, consisting of approximately 1500 ft. of 12, 18, and 36-in. pipe, the contractor's forces took out some four tons of material. It included, besides gravel, cinders, sand and sludge, such assorted items as a pair of hip boots, a 1 x 8-in. plank several feet long, and some broken rodding tools that had become jammed in the sewer six years earlier during an unsuccessful attempt to clear the pipe.

When Robinson began work on this section, at one end of the 12-in. trunk, only about an inch and a half of the pipe diameter was open; all of the rest was filled with debris.

● THIS PILE of debris is about one-half of the material removed from one of the more seriously clogged trunk sewers.

● USING modern equipment, the contract sewer cleaning crew rehabilitated 3,000 ft. of trunk sewer in eight days.

Cleaning restored more than 95 percent of the original flow capacity in this trunk, as well as in the others.

Once the Robinson crew arrived, it took a total of eight working days to rehabilitate the 3,000 ft. of trunk sewer that had been contracted for. They rodded each section and then used specially designed buckets and brushes to clear away the loosened material.

The rodding rig consists of a 20-hp. motor mounted on the back of a truck. This motor is fluid-coupled to a reel containing up to 1,000 ft. of spring steel rod. On the end of the rod is a cutting tool. The latter device, inserted into the line through a manhole, is propelled forward and backward at speeds of from 0 to 350 fpm; meanwhile, it rotates simultaneously at up to 1,000 rpm. This combination of motions permits the cutting tool to get through almost any obstruction. A good illustration is a section cleaned at Turtle Creek which was blocked almost completely for a distance of several feet with solidified concrete. The auger cleared this blockage with relatively little trouble.

After all obstructions have been penetrated, and accumulated debris has been loosened by the cutting tool, the line is bucketed. Power winches mounted on three-wheel trailers are spotted at either end of a given pipe section, adjacent to the manholes. Cables from each winch are then attached to a specially-designed bucket and threaded through the pipe. This arrangement permits the bucket to be pulled through the line alternately from either end—that is in opposite directions. The bucket brings virtually all loosened debris to the surface. Finally, a cylindrical brush is winched through the line to sweep down any remaining material into the invert.

"If we hadn't retained an outside contractor for this work," explains Street Commissioner Curran, "we would have had to buy more powerful sewer-rodding equipment for our own forces. We felt that the sewers, once cleaned, would operate many years before needing attention again; thus it appeared doubtful that we'd get the full benefit from the investment. We are convinced that retaining specialists was the most economical and effective way of rehabilitating our sewer system. By contracting the work, we obtained highly-trained manpower and powerful equipment that we couldn't duplicate ourselves.

A MODERN WATER SYSTEM for ASUNCION

FOR the first time in their 424-year history, residents of Asuncion, Paraguay, are enjoying the security and convenience of purified water piped through their own municipal system. Full scale service to 6,000 of an eventual 20,000 individual connections began last summer. For the formal inauguration of service, later in the summer, a national holiday was declared, this coinciding with the celebration of the anniversary of the founding of Asuncion.

For 90 years Asuncion had tried to finance a municipal water system but it was not until 1955 that loans totalling $9 million were procured from the Export-Import Bank and from the Development Loan Fund on the basis of a study and feasibility report made by Rader and Associates, consulting engineers of Miami, Fla. The firm then was retained to design and write specifications for the complete system to serve some 250,000 inhabitants of Asuncion who, traditionally had depended on cisterns, wells and street peddlers for their daily water supply.

Besides connections in home, business and industrial establishments, the new system includes a series of public fountains to serve those who, at present, are beyond the limits of the distribution facilities. The new supply of safe and palatable water is expected to give a tremendous boost to the development of Asuncion.

Water source is the Rio Paraguay, a stream comparable to the Ohio River in size and importance. Work began early in 1956 and went forward on approximate schedule in spite of an unnaturally rainy "dry" season, followed by a characteristically wet rainy season which resulted in a near-record river flood crest of 60.31 meters. The same unusual weather held up pipe-laying in some locations, causing washouts in some city streets.

The water treatment plant, which had its final tests last spring, is one of the most modern in the world, incorporating the latest in equipment and design. A clear well reservoir, main pumping station, plus supplementary reservoirs and pumping stations for varying levels of the city, are included in the system. Some 280 kilometers of pipe have been installed. As required by the Export-Import Bank, all imported materials used in the project had to come from U. S. sources. These were shipped by sea to

Buenos Aires, a voyage of some 7,000 miles, then transferred to a riverboat for the 1,000-mile trip north up the Rio Paraguay to Asuncion. Corposana, a corporation established by the government of Paraguay to take charge of building and operating the water system, purchased materials and equipment through numerous contracts separate from the engineering and construction contracts.

The contract with Rader and Associates required the firm to furnish a resident engineer (he is E. K. G. Borjesson) who supervised construction; and also a supervisor of operation for the two-year period following completion and testing. Training local personnel is another requirement of the contract.

Designs for the water system and its facilities were made in the Miami headquarters of the consulting engineers from data collected on the site. Drawings for the distribution system were made in Asuncion.

The Asuncion system is designed in three distribution zones to permit water to be delivered at proper pressures for the sharply varying elevations of the hilly terrain in the city. The intake point, where the raw water pumping station is situated, is nine kilometers upriver from the city. Route of the pipeline into town leads through countryside which becomes increasingly hilly as it nears the outskirts of the city. At one place the pipe has been laid through a masonry-lined tunnel under a hill. Masonry was used also to construct the reservoirs, most of which are underground and covered. Stone and skilled stonemasons are plentiful in Paraguay, but cement is costly and is available locally in only limited quantities.

Design Data

The design of the system was based on an estimated average water consumption of 250 liters (about 66 gallons) per person per day, with maximum daily consumption 125 percent of the average and maximum hourly consumption 200 percent of the average. Because the terrain varies greatly in elevation, it was necessary to provide three different pressure zones. The low pressure system serves those areas between 70 and 110 meters elevation and 25,000 cubic meters of storage (about 6.6 million gallons). The intermediate system serves areas between 105 and 140 meters elevation and 25,000 cubic meters of storage is provided for this zone. The high pressure system is for elevations from 135 to 160 meters and 3,900 cubic meters of storage is provided.

● **OPERATING** floor of the water treatment plant, showing the four filter control tables. Large gauge to indicate wash water flow is suspended from the ceiling.

● **INTERMEDIATE** zone pumping station has three electric motor driven pumps and control valves at center and left; control panel and telemetering system at right.

All distribution mains, which range in size from 4-in. to 30-in. are of cast iron.

The water treatment plant has a capacity of 56,000 cubic meters per day and consists of rapid mix, coagulation and settling and rapid sand filtration. The rapid mix chamber provides for one minute detention. The high rate upflow coagulation basin has capacity for 72 minutes detention at design flow. The surface loading is 61.1 liters/minute/square meter or 1.5 gpm per sq. ft. The rapid sand filters operate at 2 gpm/sq. ft., or 81.5 liters/min./sq. meter. The filters are built up with 18 inches (46 cm) of gravel and 30 inches (76 cm) of sand. Aluminum sulfate, sulfuric acid, lime and chlorine feeding facilities are provided. The clear well capacity is 3,266 cu. meters or equivalent to 1.4 hours of operation at design rate.

These data were furnished by the office of Rader and Associates, engineers and architects, Miami, Fla.

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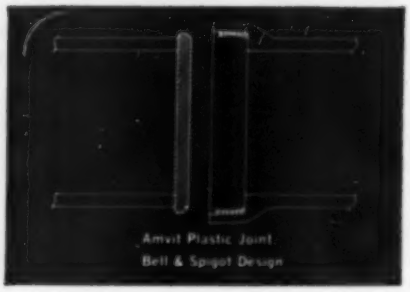

1. ROOTS

force the pipe out of line and clog the system in search of moisture. Amvit is a compression joint on the ball and socket principle. The surfaces of both bell and spigot are in constant compression. Roots cannot enter the line.

2. CHEMICAL ATTACK

is from acid-laden, high temperature sewage, discharged from dishwashers, garbage disposal units and washing machines. Like the clay pipe, Amvit Joint is acid resistant and will not corrode or decompose like most substitute pipes.

3. FLOW LINE ATTACK

refers to that section of the pipe which lies between low and high water. Grease and scum tend to build up here and act as a solvent on certain synthetic substitute pipes. The design of the Amvit Joint assures that the pipe is self-centered at all times. This gives perfect alignment and self-cleansing.

4. EROSION

is the wearing out of pipe by abrasive action of sand and gravel. Soft pipes, such as those made of paper and coal tar, become scratched and roughened and tend to clog up. Because Amvit is a really tight joint, no foreign matter can possibly enter the line.

5. DECOMPOSITION

is the chemical breakdown of the component elements of the pipe. Only clay pipe resists decomposition. Like the pipe, the joint is unaffected by ordinary conditions of underground service.

6. RODENTS AND TERMITES

will gnaw away wrappings and coatings of composition pipe. Amvit Clay Pipe defies even the sharpest toothed rodent and is immune to termite attack.

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NEWS BULLETINS

AMERICAN PUBLIC WORKS ASSOCIATION, 1313 EAST 60th STREET, CHICAGO 37, ILLINOIS

Patching Costs Over One Billion Dollars Each Year

South Bend, Ind.—At the Third Annual Meeting of the Indiana Chapter a diversified technical program included presentations on pavement patching, financing of local improvements, refuse collection and disposal, selling a planned public works program, and when and how to employ Consulting Engineers.

Professor Harold Michaels, Purdue University Joint Highway Research Project, emphasized the importance of economical patching by pointing out that over one billion dollars is spent annually by local governments for patching work. He set down three important steps to patching pavement: 1. Inspect for reason of pavement failure and remedy the cause. 2. Prepare the hole properly for filling—cut sides of hole vertical, remove loose material, apply thin tack coat 3 ins. wider than hole. 3. Place filler material. (Where applicable proper compaction of filler material is very important.)

Professor Michaels pointed out that if more than 10 percent of the paving requires patching, serious consideration should be given to tearing up and re-doing the whole street.

A question from the audience revealed that no one present knew of any city which contracts for ordinary street maintenance (Editor's note: If you do, please notify APWA Chicago Office.)

Some questions and answers on community refuse collection and disposal problems as they might be encountered in a public meeting were set forth by Leo Weaver, Assistant Director of APWA. Mr. Weaver stressed the importance of "starting from the beginning" when acquainting the public with a proposed program, citing the fact that sanitation officials often assume the public is aware of more of the background of needs and reasons for setting up a particular type collection system or the locations of a disposal site than they really are. Thus, unfortunately, misunderstandings often make it more difficult to obtain public cooperation and support of needed action.

Executive Director Robert Bugher was called upon by outgoing President Dan W. Richardson, Supt. of Streets, South Bend to install the Chapter's newly elected officers in an after-dinner ceremony. Donald W. Gwinnup, City Engineer, Anderson was installed as President, and F. Sterling Bolyard, Street Commissioner, Lafayette, Vice-President. Edward Green, City Engineer of Fort Wayne was re-elected Secretary-Treasurer. Edwin J. Denman, City Engineer, Auburn, and Dan Richardson were elected to the Board of Directors.

APWA-AGC Joint Cooperative Committee Reports

The American Public Works Association—Associated General Contractors Joint Cooperative Committee. This committee reviews problems of mutual concern to state, municipal and other public works agencies and makes recommendations for improvement of contract forms, specifications, and procedures through the sponsoring parent organizations. At a meeting during the 1959 Public Works Congress in Seattle, discussion and recommendations included:

1. *Local APWA-AGC Chapter Cooperation* — The Northern California and Mountain Pacific Chapters, AGC, both report active programs toward standardization of city and county specifications in their areas. The joint committee again indorses and recommends to local chapters of both organizations mutual cooperation.

2. *Uniform Standard Specifications*—Widely varying local conditions preclude the adoption of detailed technical specifications which would be applicable to all parts of the country. The development of standard area specifications appears to be a worthwhile project for local AGC-APWA committees and is recommended for consideration.

3. *Use of Uniform Public Works Engineering Construction Forms*—D. A. Buzzell, Committee Co-Secretary, reported on the use of the uniform contract forms developed by the committee and adopted by the parent organizations as AGC Standard Form 10 and APWA Standard Form A. A great quantity of these forms has been distributed through the two national organizations, and it was reported that a

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number of municipalities, particularly the smaller cities and towns, have adopted the standard forms with slight modifications for local use. The committee invites suggestions from contractors and public works officials for improvements in the form and revisions found necessary to improve their usefulness.

4. *Contract Construction for Building Alterations*—The committee discussed limitations placed by some states and cities on the amount of building alterations that may be performed by day labor. It was reported that some of this work is not let to contract because city or state ordinances prohibit public advisement in the absence of detailed plans and specifications. In the case of some relatively minor building alteration work, preparation of detail plans and specifications is impracticable because of the nature of the work or due to the disproportionate cost that would be involved. The committee suggests that local AGC and APWA groups investigate this problem and study the possibility of amending pertinent local regulations where it appears that this type work could reasonably be let to contract without the necessity of preparing complete technical specifications.

5. *Relocation of Public Utilities*—Specifications providing for relocation work by public utility company forces are not always definite on the time allotted for performance. This has resulted in the past in delays to contracts awaiting the completion of relocation work. It is suggested that the specifications set forth a definite schedule for utility relocation to be observed by the responsible contractor or the public utility.

6. *Faulty Location of Utilities*—Attention was called to the difficulties encountered by contractors with respect to inaccurate utility location maps. The committee recognized this problem and pointed out the need for accurate and up-to-date as-built drawings.

7. *Disaster Relief*—The AGC reports development of a plan for mobilization of contractor forces and equipment for disaster relief operations. This plan has been made available to local AGC Chapters and Branches and is now being implemented in various parts of the country. The committee indorses this plan and recommends it be brought to the attention of local public works officials.

8. *Accident Prevention in Construction*—The AGC has a very active and comprehensive accident prevention program, recognized by many federal, state, and local agencies. It was pointed out that a large number of injuries and fatalities result each year from the operations of smaller contractors who are not covered by federal, state or local safety regulations, or whose operations are so great in number that adequate inspection by appropriate authority is not possible. The attention of public works officials is invited to the savings available in the form of reduced compensation rates, prevention of work stoppages, and the like, through adequate safety program. It is further suggested that safety precautions be stressed at the time of issuing building permits.

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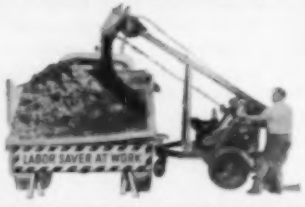
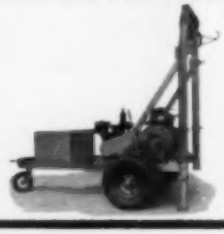


COILRODER

BUCKET MACHINE



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Iowa City Experiments With Foamed Asphalt

Muscatine, Iowa—Speaking at the eleventh annual meeting of the Iowa Chapter, Kenneth Cullen, City Engineer, Dubuque, told APWA members and their guests of the recent experimentation in Dubuque with foamed asphalt for resurfacing streets and parking lots and for patching streets. Over 95 persons

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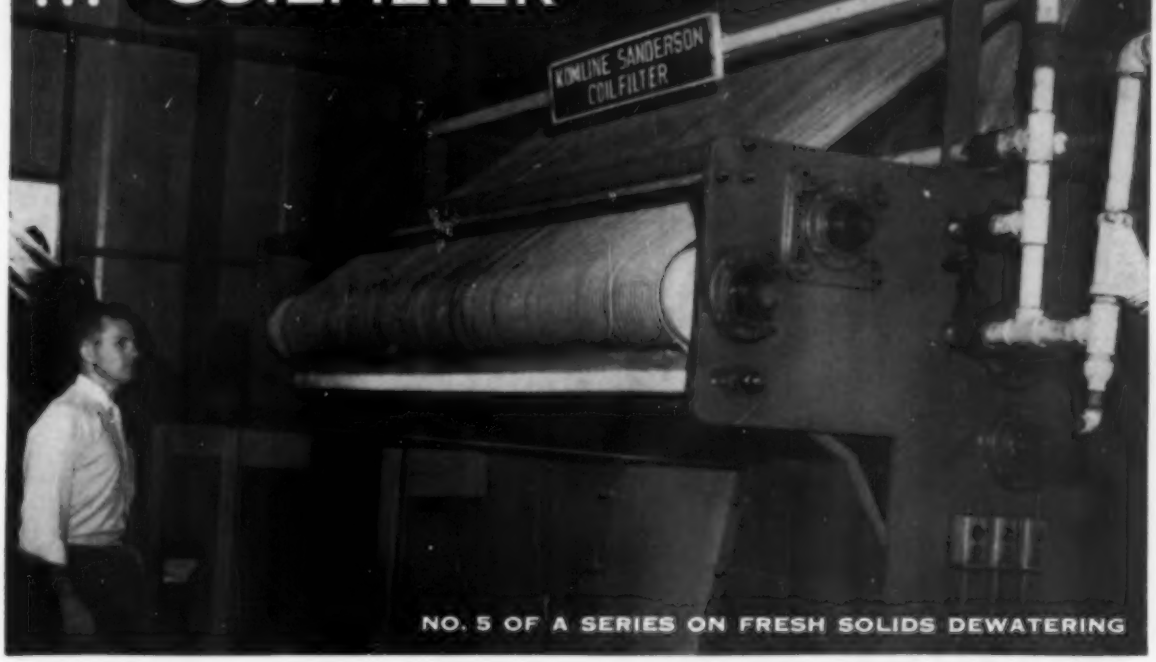


NO. 5 OF A SERIES ON FRESH SOLIDS DEWATERING

"Great strides have been made in the sludge dewatering operation. Wet sludge cake (3350 tons) with an average moisture content of 74.4% resulting in 838 tons of dry solids, was processed at an average cost of $12.78 per ton" . . . "From the information gathered at this installation, it would seem that the utilization of vacuum filtration for the treatment of raw sludge has proven to be a very satisfactory solution to the number one problem in sewage treatment." So states Arlington, Texas, sewage treatment plant Superintendent Irvin H. Nelson in his Annual Report for the operating year ending June 1, 1959. The report goes on to say "The sludge dumping area has not been a problem. The dewatered sludge, although exposed to the elements, will not re-absorb the moisture lost in dewatering."

This sewage treatment plant, designed by Reaves & Gregory for the City of Arlington, dewaters fresh solids on a 250 square foot Coilfilter. Sewage from a contributing population of 43,000 is treated.

Arlington is but one of many municipalities, with population as low as 3500, successfully dewatering fresh solids with Coilfilters.

Investigate Coilfilters, the only proved, positive method of fresh solids dewatering. Write for more information.

KOMLINE-SANDERSON ENGINEERING CORPORATION
PEAPACK, NEW JERSEY
BRAMPTON, ONTARIO, CANADA

MANUFACTURER OF COILFILTER SLUDGE VACUUM FILTERS AND AUXILIARY EQUIPMENT FOR DEPENDABLE FRESH SOLIDS DEWATERING

Street Sweepers'
CAN CARRIERS

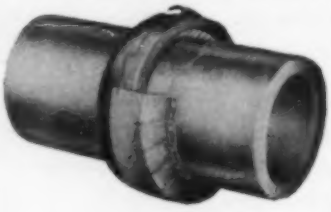
TARCO "Street Sweepers' Friend" Can Carriers are the **toughest, best balanced, easiest pushing** carts you can buy.

All welded steel construction . . . no bolts, no rivets, no dangling chains. Choice of big, easy-to-push wheels with either **pneumatic, solid rubber** or **plain steel tiring on roller bearings.** Full swiveling caster wheel. Silent can-clamp. Tool hooks. Traffic warning flag.

Make it easy on yourself all way round . . . buy longer lasting can carriers that look good; that will be less tiring for your men to push and use. Buy TARCO "Street Sweepers' Friend" Can Carriers. See your nearest TARCO dealer or write for details.

TARRANT MFG. CO.
28 Jumel Place, Saratoga Springs, N.Y.

BUILD BETTER SEWER LINES



with
WESTON
GASKETS and FORMS
for
SEWER PIPE JOINTS
(a cement joint)

- No jute used—gasket centers spigot.
- Definite space in each joint for cement.
- Form confines cement-grout to lower portion of joint.
- Particularly advantageous in water-bearing trenches.
- Infiltration minimized.

L. A. WESTON CO.
Adams Mass.

were registered to participate in this two-day event in Muscatine.

Foamed asphalt is a recent development pioneered by Professor Ladis H. Csyani of the Bituminous Research Laboratory, Iowa State University. So far, Cullen said, they have resurfaced several streets and a parking lot and have also used the new product for patching. Last summer four miles of old concrete streets were resurfaced with foamed asphalt liquid mastic at a cost of 50 cents per square yard. The cold patching material is made of AC 120-150 penetration asphalt. The results, Cullen said, have been very satisfactory. In one instance traffic was permitted on the asphalt within 15 minutes after it was laid with no apparent damage to the new surface.

Walter Pilgrim, Sanitation Superintendent for Muscatine, described how the sanitary landfill method of disposing of refuse is being used to reclaim land in Muscatine. Ravines 30 to 40 feet deep, within residential areas, have been filled in. A ravine presently being filled in will, when completed, make possible the connection of two sections of a street which previously had been considered economically unfeasible. Pilgrim stated that all of Muscatine's refuse-land reclamation projects were located within the city limits and that there is a waiting list offering the use of reclaimable land. He also said that Muscatine is considering an ordinance controlling the utilization of completed sanitary landfill sites.

An election of officers named L. H. Adams, Street Commissioner, Waverly, as President of the Chapter; J. G. McFadden, City Engineer, Newton, was elected Vice-President, and Jack Kilby, Assistant City Engineer, Dubuque, was re-elected Secretary-Treasurer. New members elected to the Board include Herman W. Wiesen, City Engineer, Bettendorf; and William W. Packard, Public Works Superintendent, Ottumwa. William D. McElwee, City Engineer, Sioux City is Immediate Past President.

Samuel Baxter Elected Chairman of Research Foundation Trustees

Samuel Baxter, Commissioner, Department of Water, Philadelphia, and Vice-Chairman of the APWA Research Foundation's Board of Trustees, was elected Chairman at the Board's annual meeting held during the 1959 Public Works Congress in Seattle, Washington. Don E. Bloodgood, Professor of Sanitary Engineering, Purdue University, was elected Vice-Chairman. Continuing their service as trustees are former Chairmen Milton Offner, Secretary, Board of Public Works, Los Angeles, and William A. Hardenbergh, Editor, PUBLIC WORKS Magazine. Other trustees serving on the Board include Milton F. Wagnitz, City Engineer, Detroit; E. J. Cleary, Executive Director, Ohio River Valley Sanitation Commission; Myron Tatlock, Consulting Engineer, Ralph L. Woolpert Co., Dayton, Ohio; F. H. Zurmuhlen, Commissioner, Department of Public Works, New York City; William Foster, Editor, American City Magazine, and Robert D. Bugher, Executive Director, who serves as Secretary-Treasurer for the Board.

Third Annual Maine Chapter Meeting

Portland, Maine — Sixty-three members and guests, the largest meeting attendance to date, were present at the third annual meeting of the Maine Chapter. The one-day program featured a field trip to a rock quarry where crushing, quarrying, concrete batching and bituminous concrete plant operations were observed, followed by two panel discussions.

A discussion on municipal sewage disposal was moderated by Chapter President Jerry G. Haynes, Field Engineer, Portland Cement Association and included Rayburn W. MacDonald, Chief Engineer, State Water Improvement Commission; Clarence M. Crosby, Kennebrink Sewer District; Douglas Dingwall, Presque Isle Sewer and Water Districts; and Thomas R. Camp, Senior Partner, Camp, Dresser and McKee, Boston. The second panel discussed disposal of municipal solid wastes and included Frank G. Chapman, Executive Secretary, Maine Municipal Association; Ralph Eye, Town Manager, Bar Harbor; James MacLeod, City Engineer, Bangor; and Rayburn W. MacDonald.

At the business meeting Franklin W. Landers, Town Engineer, Brunswick was elected President; George Trafton, City Engineer, Rockland, Vice President; and William R. Adams, Jr., City Engineer, Lewiston, Secretary-Treasurer. Elected Directors for two years were V. B. Mackeller, Sales Engineer, Bancroft and Martin Rolling Mills and George J. Maher, Director of Public Works, Lewiston; Oral Lionel Pomroy, Town Manager, Pittsfield was elected a Director for one year.

It's a fact...

PACKER BODIES Cost 1/3 Less Than Rear Loading Units of the Same Rated Capacity, Yet Hold Yards More of Compacted Refuse!

How is this possible? The answer is *simplicity* of design and operation. First, the M-B Packer costs ⅓ less because there is no heavy, complicated hydraulic tailgate involved. A simple, powerful packer plate moves through the entire length of the body compacting all types of refuse — then quickly pushes out the load through the big rear doors. Secondly, the new vertical packer plate design allows up to *4 cu. yds. of useable area above the rated compacted capacity of the body!*

Because of M-B's square, van-type body design which eliminates dead weight, the compactor body can be mounted on a low-cost, popular size truck chassis with resultant savings in lower operating and maintenance costs.

There's a size for every need: 14 to 24 cu. yd. truck mounted; 32 and 38 cu. yd. in both the Trail-Pack, self-powered trailer type models and the M-B Contain-O-Pack Self-Loading Packer system for "containerized" refuse handling.
From every angle, you're dollars ahead with M-B Packer Bodies — the choice of hundreds of private haulers and municipalities.

Money-Making Features

- **FAST OPERATION:** rugged, bulldozer-type packer plate thoroughly compacts refuse, garbage and trash . . . the complete cycle takes only a few seconds.
- **COMPLETE SAFETY** because of side loading from the curb, eliminating danger to collectors from passing traffic. All compaction mechanism located inside the body — safely out of operator's reach.
- **PACKS ANYTHING** — barrels, crates, cartons, etc. without pre-crushing. Use as general purpose truck for hauling snow, ashes, park equipment, nursery stock, leaves, etc.
- **CONTROLLED DUMPING:** full load is pushed out quickly and safely by packer plate *without raising the body* as in hydraulic-type units.
- **LESS DEPRECIATION** — low truck cost, low body cost and less wear and tear adds up to less depreciation of your original investment.
- **MORE BLOCK COVERAGE** — progressive compaction, easy loading means more tonnage per load — fewer trips to the dump or incinerator.

The proof is in a demonstration. See your distributor or write the M-B Corporation, New Holstein, Wisconsin.

M-B CORPORATION
NEW HOLSTEIN, WIS.
Manufacturers of Quality Municipal and Construction Equipment Since 1907

PACKER BODIES LINE MARKERS SWEEPERS

THE
HIGHWAY
AND
AIRPORT
DIGEST

Prepared by **FRANK FORCE,** *Digest Editor*

Fighting Snow on The New York Thruway

The 1958-59 snow and ice control program on the New York Thruway cost $1,450,000 or about $2,700 per mile for materials and labor. There are available 600 staff maintenance workers on a 24-hour-per-day schedule. They man more than 500 snow plows, trucks, salt spreaders, scrapers and other types of equipment along the 553-mile tollway system. Virtually all maintenance vehicles carry two-way radios, and their respective operating locations at all times are plotted on a large control board in a communications center in Elsmere. By utilizing the plot board and direct radio communications, Thruway engineers can direct the battle against the snow and ice storms. Detailed advanced warnings of pending storms or inclement conditions are received from the Weather Bureau and from a private weather-forecasting service. An estimated 45,000 tons of chlorides are used each year. In the snow-removal operations on the 4-lane sections of the Thruway, a large truck or two small trucks, plow to the left down the passing lane to push the snow out over the interior shoulder onto the center mall. The first trucks are followed at a distance of about 750 ft. by another unit or group of plow-equipped vehicles. These units plow the snow from the driving lane onto the outer or right shoulder. On 6-lane sections, three trucks in echelon plowing to the right, are sent down the center and right-hand lanes. These trucks are followed by another that finishes cleaning the left-hand lane and part of the shoulder. This truck travels about 750 ft. farther to the rear. Plowing to the left, it clears the lane adjacent to the center mall. On 2-lane sections, plowing is always done with trucks moving in the direction of traffic. The entire passing lane will be plowed in one pass and the driving lane will be plowed in the second pass with the snow being plowed to the right. In all cases, the snow will be winged or plowed back so that the shoulders are cleared of snow as soon as possible.

"Toughest Turnpike Winter Maintenance Job." *Roads and Streets*, November, 1959.

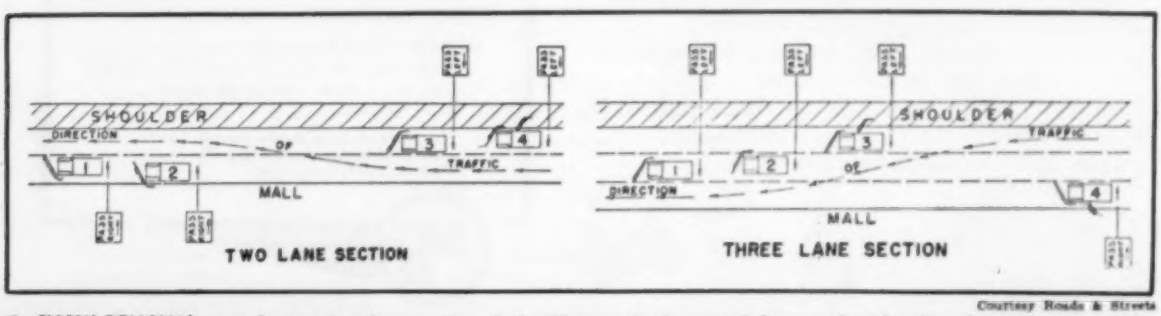
Flood Control and Storm Drainage for Roads and Streets

In Alameda County, Calif., the various jurisdictions have developed a highly successful system for cooperation in the field of flood control and storm drainage for streets and highways. The principal elements utilized in this program have been a county-wide flood control district and intelligent understanding and desire to cooperate on the part of the local governmental officials. The Alameda County Flood Control and Water Conservation District, with boundaries coinciding with those of the county, and having the County Board of Supervisors as the governing body was established in 1950. The District has a legal tax limit of 1½ cents per $100 of assessed valuation, the revenue from which may be used for general administration and planning. Financing for the construction and maintenance of flood-control and storm-drainage improvements is accomplished through the creation of zones of the District. The District has broad powers for cooperation with Federal, state and local governmental agencies, utilities and others. A comprehensive master plan of flood control and storm drainage has been substantially completed for most of the area of the County.

"Coordinating Flood Control and Storm Drainage for County Roads and City Streets." By Herbert G. Crowle, Director of Public Works, Alameda County, Oakland, Calif. PUBLIC WORKS, December, 1959.

Grade Separations For Built-Up Streets

A new facility which may be considered a prototype for arterial intersection development in Chicago, is the partial grade separation at



Courtesy Roads & Streets

● **SNOW REMOVAL procedure on two-lane section of the Thruway is shown at left; procedure for three lanes shown at right.**

$7.50 / hour operates 2 Michigans

Cost averages 20,000 hours, hundreds of different jobs, including plowing, loading of record snow

It all started January 16. Temperatures dropped to near zero. The wind whipped up. Snow began to fall. By dusk, the blizzard had dumped 17 inches on the ground, level measure. Drifts were 6 and 8 ft deep—and growing. Traffic was halted throughout the city—South Bend, Indiana.

Yet, this was only the beginning. By the end of the month, *45.1 inches had been measured.* It was the heaviest snow month, *by 10 inches*, in the 63 year records of the U.S. Weather Bureau in South Bend! A terrific workout was given the City's entire equipment fleet.

Work 18 straight 24-hour days

Among this fleet were two veteran four-wheel-drive Model 75A Michigan Tractor Shovels. These units worked continuously, 24 hours a day, for 18 straight days. They helped clear intersections. They plowed snow too deep for graders and truck plows. They loaded windrows in the downtown area. Their speed and versatility helped the City Street Department post an enviable record—despite high winds, subzero temperatures, and the deep drifts, not a missed garbage collection, milk delivery, or stuck emergency vehicle.

No repairs needed

"Our Michigans did a fine job!" says Dan Richardson, City Street Commissioner. "In the 18 days of continuous work, they stopped only for refueling and changing operators—yet, despite the long hours of work and exposure to moisture, cold and wind, we didn't have to do a thing repair-wise."

Cost includes wages, maintenance depreciation

Operating costs, overall, have also been exceptionally low. The City of South Bend has had the two Michigans for years—one almost six years; the other, almost four. In 20,000 work hours, total, they have had virtually no downtime. Major repairs, for instance, have cost only $1,500—*$2.88 per machine per week!* Tires on the newer machine are original . . . the City sets aside $5 per machine per week for replacement. Other costs, according to department records, have averaged only $3.55 per hour—*including* wages ($1.85), fuel, oil, maintenance, depreciation ($1.00 per hour), and insurance.

Jobs done? Literally hundreds of different kinds. Snow removal. Street rebuilding. Truck-loading of stockpiled gravel, fill dirt, cinders, and salt (5 yd trucks in 2 minutes). Back-filling. Street cleanup. Retrieving jammed sewer buckets. Extinguishing landfill fires. Loading broken concrete.

"No matter *what* the assignment," says Commissioner Richardson, "our experience has proved you can depend on a Michigan Tractor Shovel to get there fast, do the work fast, and without trouble!"

Michigan is a registered trademark of
CLARK EQUIPMENT COMPANY
Construction Machinery Division

CLARK EQUIPMENT

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Benton Harbor 38, Michigan
In Canada:
Canadian Clark, Ltd.
St. Thomas, Ontario

Archer Ave. and Ashland Ave. Archer Ave. has a traffic volume of 27,000 vehicles per 24 hours. The northeast and southwest approaches of Archer Ave. to the Ashland intersection had a constant back-up of traffic during the rush hours. Similar conditions were also prevalent on the north and south approaches of Ashland Ave. A traffic analysis showed that a reduction in the through vehicles (those continuing across the intersection) of about 50 percent would afford ample signal time for full clearance of all vehicles on all four approaches. The overpass which provided partial separation of vehicles within the narrow right-of-way, provided two 12-ft. lanes on the bridge section for through vehicles on Archer and two 11-ft. surface lanes on either side of the structure. A 5-lane pavement cross-section was incorporated at both entrances to Ashland, made possible by the "T" column design for the overpass. This 5-lane section provides 3 lanes of traffic on the approach side; an exclusive left-turn lane, right-turn and bus-stopping lane, and a through lane for vehicles that enter Ashland in the immediate vicinity of the structure. Stage construction of the bridge approaches and structure was planned to maintain traffic flow.

"Partial Grade Separation Designed for Built-up Streets." By George Hollich, Bureau of Street Traffic, City of Chicago, Ill. *Street Engineering*, November, 1959.

Latest Techniques Used In Tunnel Lighting

The 3,435-ft. long Webster Tube, a two-lane, vehicular tunnel under the Oakland-Alameda Estuary in California, will soon be under construction. The tube will have tiled walls and ceiling and a continuous-line fluorescent lighting system which will provide adequate driver visibility, particularly during the daylight hours. In order to insure good daytime visibility into the tunnel entrance for approaching drivers, 60-foot-lambert lower wall brightness is required to silhouette clearly vehicles within the entrance. The lower wall brightness in the central zone will be at least five-foot-lamberts to provide good daytime visibility of vehicles. A lower wall brightness of only one-half foot-lambert in the entrance and central zones will provide good visibility of vehicles during the night. Other lighting design features incorporated into the tunnel are as follows: Special light control characteristics to provide relatively uniform wall and ceiling brightness; lamps shielded from driver's view; dust and spray-tight fixture construction without sacrificing ease of relamping; one-piece plastic cover which can be easily removed for cleaning and does not require a metal frame or other hardware attachment; branch circuit or feeder wireway within fixture shell; and high-voltage branch circuits.

"Tunnel Lighting." By Harold Skootsky, Senior Highway Electrical Engineer and John R. Brass, Associate Highway Electrical Engineer, California Department of Public Works. *California Highways and Public Works*, September-October, 1959.

Circular Reinforced Concrete Columns

Based on the bridge specifications of the American Association of State Highway Officials for allowable loads, a procedure for designing eccentrically loaded round columns has been developed by the author. Under the enlarged highway

HI-WAY Model E Spreader

Fast, one-man operation, fewer reloads, better traction, 4 to 40 ft. spreads of sand, salt or cinders!

3 Different Models Available: Truck mounted with PTO drive — easy to operate, economical to use. Truck mounted, engine powered (hydraulic drive available) — for more accurate, positive spreads. Dump body mounted, engine powered — use one of these lower cost rigs with several trucks, on or off truck in minutes. Capacities up to 8.8 cu. yds. mean fewer trips to the stockpile. Wide conveyor and steep 45° sides prevent bridging.

Other Model E Features
- 24" heavy duty conveyor
- 20" spinner with replaceable fins
- Removable inverted "V" over conveyor on 13 and 15' models
- Complete control from cab
- Accessory equipment for every need

Write for the latest literature and complete specfications.

HIGHWAY EQUIPMENT COMPANY
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HI-WAY
S-P-R-E-A-D-E-R-S
SALES & SERVICE

Hi-Way Spreaders . . . protecting today's motorist through better ice control.

Portland Profits By Resurfacing Streets With CATIONIC BITUMULS

Distributor applies Cationic Bitumuls at 0.2 gal./sq. yd. Note "skirt," designed to protect against drift or splash.

Truck immediately applies 25 lbs. of cover stone (¼"-#10) using tail-gate spreader. Two passes by three-wheel steel roller completes job.

The City of Portland, Oregon, is about to complete its second successful season of Single Surface Treating city streets using Cationic Bitumuls.

Last year, Cationic Bitumuls was used on more than 80% of a total of over one million square yards of such work. Costs averaged out at about 12 cents per sq. yd. as opposed to 16½ cents for similar work using an asphaltic cutback. This year, the program will include at least 800,000 square yards. Conservatively, this means a saving of over **$70,000 in two years!**

Here's the type of tightly bound surface being put down with Cationic Bitumuls in Portland, Oregon.

WHERE THE ECONOMY DEVELOPS

According to officials in Portland, the savings can be traced to the following factors: less aggregate required; smaller crew; less binder; faster operation.

In addition, Cationic Bitumuls holds even siliceous aggregates. And it extends the working season because it gives extra protection against wash-off of binder when early rain is encountered.

FUTURE PLANS

Current plans call for a continuing program involving the resurfacing of 50 to 60 miles of streets each year. At this rate the City will continue to save approximately $35,000 per year as compared to earlier methods.

Investigate the benefits of using Cationic Bitumuls in your street and road work. Call our nearest office for full information, today. Your community, too, can **profit** just as Portland is doing.

American Bitumuls & Asphalt Company

320 MARKET, SAN FRANCISCO 20, CALIF.
Perth Amboy, N. J.
Baltimore 3, Md.
Cincinnati 38, Ohio
Atlanta 8, Ga.
Mobile, Ala.
St. Louis 17, Mo.
Tucson, Ariz.
Portland 8, Ore.
Oakland 1, Calif.
Inglewood, Calif.
San Juan 23, P. R.

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construction program, bridge engineers will more frequently be confronted with the problem of designing round columns for bridge pier bents. The principal benefit of this article will be derived from the method outlined in the text, which will assist bridge designers who may want to expand the graphs presented or make similar graphs for different bridge column sections. Plotted curves are given for a range of 24 to 60-in. diameter columns in 6-in. intervals and for three quantities of reinforcing steel. In design problems for which the graphs are applicable, considerable tedious work will be avoided.

"Circular Reinforced Concrete Columns Subjected to Direct Stress and Bending." By A. Anthony Toprac, Associate Professor of Civil Engineering, University of Texas. *Public Roads*, December, 1959.

Promoting Safe Driving On the Kansas Turnpike

Enforcing safety rules for an 80-mph speed limit on the Kansas Turnpike can become a problem. The minimum speed limit is 40 mph for the 236-mile expressway. Since the new limits were established three years ago, traffic has increased 31 percent, but injury accidents are down more than 50 percent and the 1959 death toll is below that for the first full year of operation and only half the 20 fatalities that were listed for 1958. The latest radar check disclosed the average speed is only 67 mph with an 85 percental speed of 74.9 mph. The built-in roadway safety features and strict enforcement are the keys that have dropped speed into third place as the cause of Kansas Turnpike accidents. Slick roads during rainy or icy weather tops the 1959 list with 53 accidents, followed closely by sleeping drivers blamed for 49 crashes and speed in 23 instances during the first 9 months. The turnpike's accident rate is 101 per 100,000,000 vehicle-miles, or one accident for every 995,101 miles driven this year. Limited access is one of the safety features with only 16 points of entry or exit along the road. There are no rail, grade or intersecting highway crossings. The four-lane highway is divided by a 20-ft. depressed median, designed not only for better drainage but for safety as well. Both rigid and flexible pavements are used and they have skid-resistant surfaces. Spiral easement curves are worked into the alinement to eliminate monotony in driving. The roadway shoulders, 10 ft. wide on the outside for emergency stops and 4 ft. wide on the inside, also are surfaced. The coarse surface texture of the shoulders serves as a warning to drivers that they have wandered off the main roadway.

"Promoting Safe Driving on 80 mph Kansas Turnpike." By L. W. Newcomer, Chief Engineer, Kansas Turnpike Authority. *Better Roads*, November, 1959.

Epoxy Adhesives in Concrete Construction

Epoxy adhesives have been used on both concrete and asphalt surfaces, to bond new concrete to old, to bond precast concrete sections, to anchor traffic bars to road surfaces, to level chuck holes, to fill cracks, spalls and depressions, to bond traffic buttons to the roadway surface and to bond steel dowels into concrete pavement. In fact, for the past five years adhesives with an epoxy resin base in liquid, paste and grout forms have been undergoing tests as bonding agents for concrete in highways, bridges, aircraft runways, buildings, streets and sidewalks. Results of the test have been impressive. Epoxy adhesives have proved versatile and easy to use; they form bonds that are actually stronger than the concrete itself. Costs for

KOEHRING

Performance reports from Skooper owners prove . .

400 tons an hour with only 64 hp

OHIO — Koehring 205 Skooper with 2½-yard rehandling bucket was clocked loading from stockpile into trucks. Time studies showed production rate of approximately 400 tons an hour with the 64 hp machine! Discharge height: 12'-10" at beginning of dump, over 10' after dumping.

Macadam breakout easy with SKOOPER

LOUISIANA — On street resurfacing, old pavement was peeled off, loaded out by Skooper alone. No preliminary ripping or breaking. Powerful 7-foot level crowd action coupled with tremendous hydraulic break-out force enabled the operator to maintain grade, held grader work to minimum.

materials and labor frequently are less than half those of conventional repair methods. In many cases the use of these adhesives will speed repairs so that traffic can move over a repaired area in about three hours.

"Epoxy Adhesives in Concrete Construction." By R. W. Gaul and A. J. Apton, Adhesive Engineering Division of Hiller Aircraft Corp., San Carlos, Calif. *Civil Engineering*, November, 1959.

Interstate Highway System in Kansas

There are three Interstate routes in Kansas and they will be constructed to established standards and specifications in both urban and rural areas. There are a few exceptions, however, especially in widths of median strips in rural areas. Portland cement concrete and asphaltic concrete will be the surfacing materials on the routes. The concrete pavement being used is 9 in. thick, laid on a 4-in. granular sub-base. Each 2-lane section of the 4-lane routes is 24 ft. wide. The pavement is reinforced with 61-lb. wire mesh with doweled contraction joints at spacings of 61½ ft. Expansion joints are used only at fixed objects such as bridge ends. Sawed longitudinal and transverse joints are used on concrete pavements, and tie bars are used along longitudinal joints. Thickness of flexible pavement is determined by the Kansas triaxial method of design. This method uses an empirical formula which integrates data on traffic volume, rainfall, subgrade soil, sub-base, base and surface to provide a rational and balanced design. Numerous preliminary tests are correlated with field performances on existing pavements to establish the method. Shoulders of all Interstate routes in Kansas are stabilized—constructed of crushed stone with a bituminous-treated surface. Thickness varies from 5 to 9 in. and they are 6 ft. wide on the inside and 10 ft. wide on the outside of each 2-lane section. Bridges used for stream crossings are as follows: Deck trusses; continuous welded deck plate girders; continuous reinforced deck girder spans with rigid frame piers; continuous reinforced concrete slab spans with round column piers poured monolithic with the superstructure; reinforced concrete spandrel-filled arches; and reinforced concrete rigid frame box culverts and multiple box culverts.

"The Interstate Highway System: A Report on Progress in Kansas." By Thayne Smith, Director, Public Information Dept., State Highway Commission of Kansas. PUBLIC WORKS, December, 1959.

Street Maintenance Expedited With Organized Operations

San Francisco's climate permits the performance of street repair activities during all seasons of the year. All work except asphalt resurfacing is done on a 12-month basis. There are 185 miles of major streets, 618 miles of secondary streets and 14 miles of state highways to maintain. Provisions of the city's charter impose the following limitations on the Bureau's expenditures: 1) Routine maintenance and operation as provided in annual budget; 2) routine repair—as provided in annual budget but limited to jobs estimated to cost less than $2,000; and 3) new construction, same limitations as routine repair plus approval by city's chief administration officer. For the past several years the Department has limited its program to the production and use of 50,000 tons of asphaltic mixtures per fiscal year from the city's own asphalt plant. All employment is subject to civil service as provided by salary and appropriation ordinances adopted by the

. . there's nothing like it — on wheels or tracks!

Take the full-revolving swing of a shovel, add the big bucket capacity and versatility of a tractor loader, and what do you have? *A new concept in speed loading* — with none of the usual drive-in, back-out waste motion of front-end loaders, none of the high tire or track maintenance of skid-turn operation. Skooper swings through continuous dig-swing-dump-return cycles without traveling — crowds 2-yard bucket along 7-foot level clean-up from "stand-still" position. Result: more versatility, more output, at substantial savings in fuel and maintenance costs. That's not all! Standard shovel-hoe-crane attachments make Skooper a doubly-sound investment for your carefully-budgeted dollars. Call Koehring® distributor, or write us for full details.

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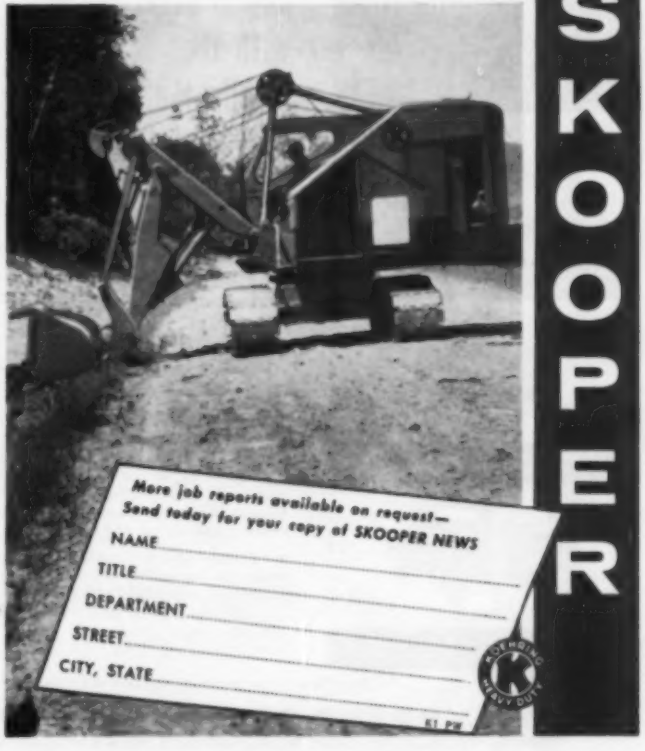
3026 W. Concordia, Milwaukee 16, Wis.



Keeps traffic open during clean-up

KENTUCKY — Highway department's Skooper cleans ditches, trims shoulders, banks, clears rock slides — stays in one lane, keeps other lane open to traffic. Skooper bucket reaches below the grade, above the grade, crowds straight ahead, or cuts at any angle of the bank slope.

city's Board of Supervisors. Routine work includes the maintenance and repair of improved streets, gutters, curbs, retaining walls, guard rails and fences, elimination of hazards in unimproved streets and the maintenance of city dumps. Also included is the maintenance and operation of three lift bridges and one vehicular tunnel. Small, semi-specialized crews have been found most satisfactory. They can be combined as necessary to accomplish given jobs. One crew may assist two or more other crews during any day. The different crews are as follows: Machine resurfacing; hand resurfacing; general repair, asphalt; compressor; utility; cleanup; concrete repair curb-setting; and sealing.

"Street Maintenance in San Francisco." By Fred D. Brown, Supt., Bureau of Street Repair, Dept. of Public Works, San Francisco, Calif. *The American City*, November, 1959.

Greeley, Colorado, Has Had 90 Years of Planning

The early planners of Greeley, Colorado, decided that all village streets would be 100 ft. wide and all rural roads 60 ft. wide. The village was laid out on a grid pattern with 20-ft. alleys crossing the center of each block, except for the blocks designed for the business district which had an additional T-alley 16 ft. wide. All blocks were designed 400 ft. square except two tiers of lots through the center of the village which were only 250 ft. one way and 400 ft. the other. Through the years the city has acquired enough land to provide the 25,000 citizens with about 200 acres of park areas. The first water filtration plant was built in 1906, 38 miles from the city with one 16-in. wooden transmission main to pipe the water to the city. Today there are three steel lines 20, 27 and 30-in. to bring the water to the city and the present water supply could support 100,000 population. In 1954, the first Planning Commission was established, and the first projects consisted of subdivision regulations, a thoroughfare plan extending beyond the city limits and review of the zoning ordinance. A long range program for municipal parking lots was planned, and 25 percent of the parking meter revenue is now deposited in a special fund for acquisition and development of off-street parking lots. In 1956, a land use and population study was made and the growth of Greeley projected to 1980. Some facts found are as follows: Of the total area of Greeley 41.9 percent is devoted to residential uses; 76.8 percent of the total residential zones is occupied by single family dwellings; 16.3 percent of the residential zones is devoted to two-family dwellings; and industrial zones account for 3.6 percent of the total city property.

"90 Years of Planning." By B. H. Cruce, City Manager, Greeley, Colo. PUBLIC WORKS, December, 1959.

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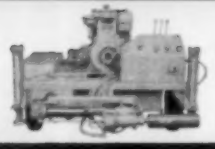

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Other Articles

"Same Test for **Paint and Plastic Markings.**" Washington, D. C., requires each bidder of paint and plastic marking material to submit a sample of his product for testing on city streets. By R. G. Wessels, Procurement Officer, District of Columbia. The American City, November, 1959.

"**Safe Winter Roads** at Reasonable Cost." Scranton, Pa., finds rock salt indispensable in maintaining their 306 miles of streets against snow and ice. By John Washo, Director of Public Works, Scranton, Pa. The American City, November, 1959.

"Sprinkler Irrigation **Speeds Sand Grading.**" By S. A. Selway. Modern Highways, October, 1959.

"How Connecticut Reduces **Guard Rail Weeding Costs.**" 75 percent of roadside vegetation control will be done chemically in five years and these

chemicals will be of four types—sterilants, growth inhibitors, and selective and non-selective herbicides. By William C. Greene, Landscape Engineer and John L. Wright, Engineer of Roadside Development, Connecticut State Highway Dept. PUBLIC WORKS, December 1959.

"Rubber Flapper Yield Signs Used Effectively." These signs supplement signs at left or right side of the street in an effort to reduce intersection accidents. By Douglas J. Carmody, Director of Parking and Traffic and Kenneth Cruce, Engineering Aide, City of Modesto, Calif. Street Engineering, November, 1959.

"County **Bridges."** Flood Damage Restored With Federal, state and local funds. By W. C. Kiedaisch, Supervising Bridge Engineer, California Department of Public Works. California Highways and Public Works, September-October, 1959.

"Pioneer Tunnel Bored by **'Hand Rock' Methods."** Jacklegs and hand drills used by tunnel stiffs recalled old mining days, but got results in making exploratory bore for a Colorado Interstate relocation. By James P. ap Roberts, Estimating Dept., Oberg Construction Corp., Northridge, Calif. Roads and Streets, November, 1959.

• • •

Parking Meter Rate Evaluation Study

The probable effect of an increase in parking meter rates to 10 cents an hour was studied by the Traffic Engineering Division of the Bureau of Engineering of San Francisco. The study dealt with the effect on parking practices and on the probable increase in revenues. It appeared from the study that an increase in rates would have little effect on turnover and occupancy. An increase in revenue appeared likely which could be used to finance about 2,300 off-street parking stalls in neighborhood districts and to acquire land for 1,900 stalls in the downtown district.

Public Utilities for Henrico County

The Code of Virginia permits counties to create sanitary districts for constructing, maintaining and operating certain facilities or utilities among which are water service, sewer service, refuse collection and street lights. There are 14 Sanitary Districts in Henrico County.

In 1958, there were 259 miles of water mains, 760 fire hydrants, 23 deep wells, 201 miles of sewers, 11 sewage treatment plants, 25 sewage pump stations, 12,283 refuse collection customers, 2 landfill dumps and 190 street lights in the Sanitary Districts.

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Modern Traffic Signals Reduce Accidents

Traffic signal modernization at trunkline intersections in Wayne and Branch counties, Mich., reduced accidents and injuries at these intersections by more than half, according to State Highway Department studies. One year before-and-after studies, made by the Department's Traffic Division, at the junction of US-24 (Telegraph Rd.) and Schoolcraft Ave. in Wayne County, and at M-78 and Dunks-Milligan Rds., in Branch County, showed that total accidents at these two intersections dropped from 91 to 39, and total injuries from 41 to 14, for a 57 and 66 percent reduction, respectively, following the modernization work. At the intersection of US-24 and dual, divided Schoolcraft Ave. where accidents were cut from 76 to 36 and injuries from 34 to 14, the work included the addition of a second traffic light and a delayed amber light, which allowed traffic to clear completely the intersection before the opposing traffic lane started to move. This work primarily reduced right angle and rear-end collisions here. At the M-78, Dunks-Milligan roads intersection, where accidents dropped from 15 to 3 and injuries from 7 to none, the work included the installation of oversize curve signs, route markers and an arrow which emphasized a 45-degree turn on the M-78 route. Prior to the installation of these signs a majority of the accidents here involved the motorist failing to make the turn and skidding off the roadway. The oversize signs helped reduce this type of accident.

Psychoda Control for Trickling Filters

The filters at the Alliance, O., sewage treatment plant can be flooded for filter fly control, but benzine hexachloride has been used with good results. An application of 5 gallons per acre is sprayed on the filter surface monthly during the critical period of the summer.

Arlington County Refuse Collection and Disposal

In Arlington Co., Va., trash and garbage are collected once a week by the Sanitation Division. Ashes are collected weekly during the winter months and at other times on special request. Streets are cleaned in business areas either daily or every other day. Dead animals are picked up from streets during the regular working hours. Weeds are cut on vacant lots if the owner does not do so after due notice.

The refuse incinerator has four 150-ton furnaces with space for a fifth furnace. In 1957-58 a total of 66,928 tons of refuse was burned in the incinerator. In 1958-59 a total of 63,628 tons was burned, a decrease of 5.0 percent. The decrease is attributed to the continuing effort to keep out-of-County refuse out of the Incinerator. There has been a decrease of almost 10,000 tons in the total burned in the past two years. A total of 8,805 dead animals (brought in by the Animal Welfare League) was incinerated.

The cost of operating the refuse collection and disposal system was $3.50 per capita, compared with $3.41 in 1958 and $3.42 in 1957. Per capita cost of street cleaning was 36 cents.

Cartoon Series Features Preventive Maintenance

HEY SPEEDY — It froze up last night — Ya better thaw them tracks loose from the ground before you start this morning
HORSE FEATHERS — this ain't no sewing machine you scrawl, — It ought to break out of a little frost —
VROOM
WAIT! DONT TRY IT!
HOLD IT!
HOL-
TOO LATE
SOB
I TOLD HIM!
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A SERIES of clever original cartoons, pointing up the importance of preventive tractor maintenance, is offered free to owners and operators of construction equipment. Printed in four colors on heavy paper, the eye-catching 11" x 13" posters contain no advertising and are suitable for tacking on field shacks, shop walls and bulletin boards, or framing for more permanent display. Featuring cartoon characters in typical job situations, the series "sells" proper tractor maintenance in a humorous, enjoyable manner and is keyed to seasonal problems. You can order as many copies as you need of the cartoon shown here, by sending your name, title, address and company name to: J. I. Case Co., Industrial Advertising Department, Racine, Wisconsin. New cartoons will be mailed to you as released.

TRANSPORTATION SYSTEMS

I am interested in any articles or information that you may have available on local transportation systems for a city of about 100,000 people. I have observed that your articles are always very interesting and informative, and I assure you that any information that you may be able to provide will be greatly appreciated.

D. R. VonRaesfeld,
Public Works &
Utility Director
Santa Clara, California

Editor's Note: We hope our readers will send pertinent information to Mr. VonRaesfeld.

THAT SEWER TAPPING DEVICE

In our November issue, on page 138, we published a description of the Shewer Tap Co. device for tapping into sewer lines. We neglected to give the local address and a number of letters have been returned to the writers. The correct address is Box 1301, Kansas City, Mo.

The Editors
PUBLIC WORKS Magazine
Ridgewood, N. J.

• • •

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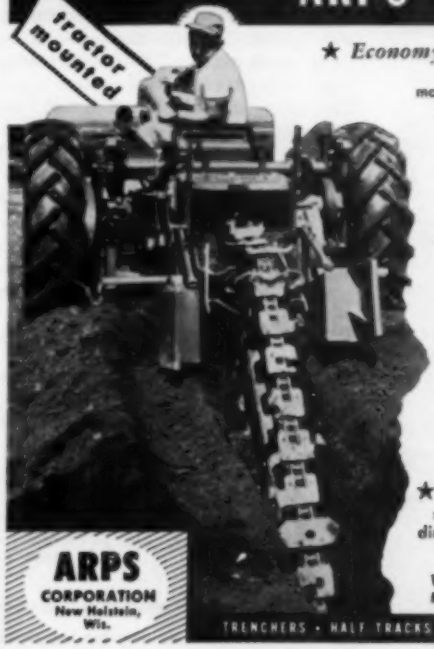

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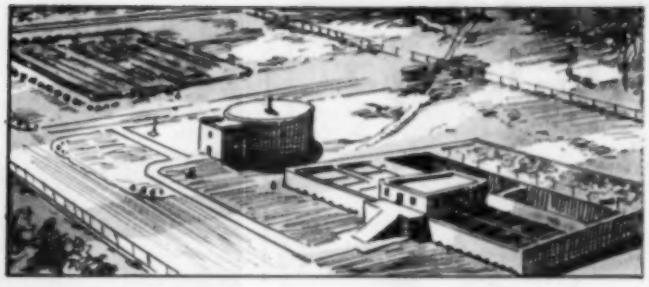


Prepared by **ALVIN R. JACOBSON, Ph.D**

Associate Professor and Head, Division of Sanitary Science, Columbia University School of Public Health

Applying Contact-Stabilization

The Bergen County Sewer Authority is currently planning a major extension of its collection system which will almost double its present flow, necessitating additions to the existing facilities at Little Ferry, N. J. Consideration has been given to the introduction of high-rate biological treatment in order to keep construction costs to a minimum. From the laboratory studies the contact-stabilization method of activated sludge treatment appeared to offer a satisfactory and economical solution to the problem of providing future plant facilities. Oxygen requirements, stabilization time, mixed-liquor contact time, and load data were obtained from these experiments. Based on the factors thus derived, full scale plant operation using the process was begun and continued over a period of two years. Detention times for sludge stabilization and mixed-liquor contact were varied to establish failure levels and peak efficiencies. The efficacy of the process is largely dependent on the effectiveness of the stabilization process, temperature of the sewage and uniformity of incoming BOD and suspended solids. High efficiency has been obtained by its utilization. Frothing, which developed under standard aeration and required application of defoaming agents for control, was reduced to negligible amounts under the contact-stabilization process. Based on an average flow of 14 mgd over the period during which the process was employed, it appears that the present aeration tank capacities are sufficient to treat at least 56 mgd, or twice what would normally be considered adequate under standard aeration.

"An Application of the Principles of Biological Engineering to Activated Sludge Treatment." By H. R. Zablatzky, M. S. Cornish, and J. K. Adams, Chief Operator, Chemist and Superintendent, Bergen County Sewer Authority, Little Ferry, N. J. *Sewage and Industrial Wastes*, November, 1959.

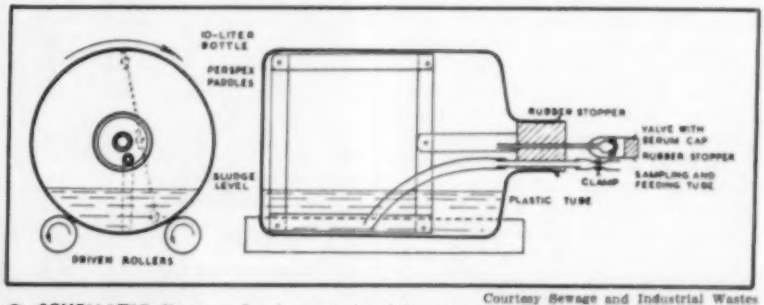
Sludge Digestion

A series of laboratory studies were made to determine the influence of detention time on the end products of anaerobic sludge digestion. In this work it was found feasible to use rotating sludge digesters, which were found simpler to operate than the commonly used gas recirculation or mechanical stirring equipment. In addition it was found more convenient to use simple pressure measurements at constant conditions for the calculation of gas production data. From the results of these experiments it was concluded that the most efficient performance of the digester was reached with 10-day detention. The efficiency of the digester was judged on the basis of the destruction of volatile matter introduced into the digesters, gas production, reaction velocity constants, and physical characteristics of the digested sludge. Gas adsorption chromatography was employed for analysis of the fermentation gas. From these analyses the methane concentration was found to lie in the range of 70 to 79 percent by volume; carbon dioxide, 21 to 30 percent; and there were traces of nitrogen. Measurements of sludge filterability appeared to support the conclusion that a 10-day detention time was the optimum for the particular conditions of the experiment.

"Use of Gas Chromatography In Sludge Digestion." By Jerzy Chmielowski, James R. Simpson, and Peter C. G. Isaac. Public Health Engineering Laboratory, Dept. of Civil Engineering, University of Durham, King's College, New Castle upon Tyne, England. *Sewage and Industrial Wastes*, November, 1959.

Metropolitan Seattle

Confronted by many problems growing out of the torrential expansion of the suburbs outside of Seattle, a new agency of local government called the Municipality of Metropolitan Seattle, was organized. Although it is permitted by law to assume six public services, as a beginning and to cope with the most serious problem, it is now confining its efforts to remedy the sewage disposal crisis in the Lake Washington drainage basin. This article tells how the Municipality of Metropolitan Seattle was formed to



Courtesy Sewage and Industrial Wastes

● **SCHEMATIC diagram showing rotating laboratory digestor used in sludge studies.**

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TYLOX "C-R" Gaskets are for tongue and groove, or bell and spigot concrete pipe of all sizes having a recess on the pipe tongue, or spigot, in which the joint medium is seated. When planning waste disposal lines using recessed concrete pipe, also plan on TYLOX "C-R" pipe joints, and be assured of these performance advantages:

WON'T ROLL OR TWIST — the wide, flat design of the Gasket, plus support provided on both sides by walls of the recess, prevents Gasket from being rolled or twisted out of true position during coupling operations.

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RESISTS ACID ATTACK — TYLOX "C-R" Gaskets are made of rubber or neoprene specially compounded for immunity to sewerage and industrial wastes acids or alkalies. Under ground and under compression, they outlast the pipe itself.

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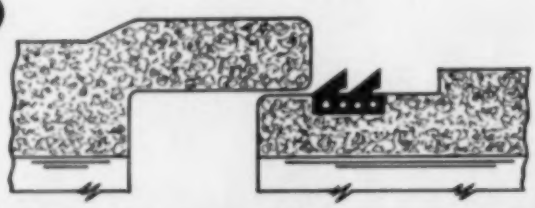
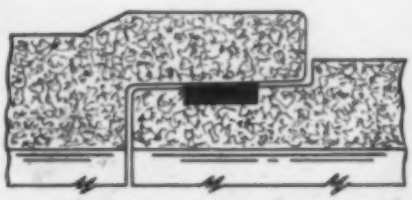


TYLOX "C-R" Gasket properly positioned on recessed concrete pipe.

2



TYLOX "C-R" Gasket under full compression.

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cope with the problems of "exploding suburbs." During the past seven years, the citizens of Seattle's Metropolitan area have studied the dilemma, formulated a remedy, obtained an enabling act from the legislature, secured the assent of the voters and established the new Municipality of Metropolitan Seattle to cope with this problem. The Metropolitan Council has borrowed $100,000 from King County and $395,000 from the federal government to start drafting plans for the first construction stage of the metropolitan sewage system, to cost $50,000,000. As the need arises in the future, the new public agency will tackle the additional public services of garbage disposal, mass transportation, planning and parks and recreation, as permitted by statute.

"Metropolitan Government Will Plan Sewage Disposal for the Seattle Area." By C. A. Crosser, Executive Secretary, Municipal League of Seattle and King County. PUBLIC WORKS, December, 1959.

Superior's Treatment Plant

The new sewage treatment plant in Superior, Wisc., was designed for operator efficiency. The 15 mgd capacity plant was built at a cost of $1.5 million. Raw sewage reaches the treatment plant through a by-pass structure which has a fixed concrete weir. When the total flow from the combined sewer system exceeds 15 mgd the excess-flow goes over the weir and is by-passed to the lake. The sewage to be treated flows through a mechanically cleaned bar screen into a concrete wet well having a capacity of about 10,000 gallons. From here the raw sewage is pumped to an aerated grit settling tank consisting of two compartments each equipped with three hoppers. A pinch valve, installed in each hopper is opened and closed by means of compressed air on a time clock arrangement. Sewage then flows to four longitudinal settling basins. The sludge is pumped from these basins through the heat exchanger into the primary digester. The plant effluent flows into a 36-inch corrugated steel outfall line. Facilities were installed to permit three-point application of chlorine at the by-pass structure, at a prechlorination manhole located ahead of the sedimentation tanks and at the effluent manhole. The digesters are provided with a means for circulating the sewage gas to accelerate the digestion process and to prevent the formation of the scum layer on the top of the digester. Digested sludge is elutriated in plant effluent for 10 minutes and then pumped to vacuum filters. A portion of the filter cake is used as fertilizer by the City Park Board and the remainder as fill.

"Sewage Treatment Plant Designed for Operator Efficiency." By Lester D. Lee, President, Hitchcock & Estabrook, Inc., Consulting Engineers, Minneapolis, Minn. PUBLIC WORKS, December, 1959.

Utilization of Liquid Sludge

The City of San Diego, Calif., has explored the feasibility of developing a less expensive, but equally beneficial, method of sludge disposal from its primary sewage treatment plant. The disposal of digested sludge at this plant has been effected through elutriation, vacuum filtration, and other normal steps attendant to the production of fertilizer. The City, assisted by the faculty of the Department of Civil Engineering, University of California, investigated the application of liquid digested sludge onto waste land both for disposal and soil improvement. Loadings from 10 to 100

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Hamilton's new sewage treatment plant is the culmination of a ten year sewerage improvement program. Serving Hamilton directly, this fine new plant helps to restore the Great Miami River just before discharging into the Ohio. Twenty-five miles from Cincinnati, Hamilton is a growing city which is proud to shoulder its share of the responsibility in the Ohio River Valley Clean-up Program.

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tons of dry solids per acre of sludge, the additions of commercial fertilizers, and leaching with local water before planting were investigated as to their effect on the quantity of barley which the plots could produce. As a result of the study the City has found land disposal to be a satisfactory and practical method of utilizing the liquid digested sludge. Sludge conditioning and drying facilities have been shut down, and all the sludge produced now is being utilized for the improvement of soils. The changeover from fertilizer production to land disposal of the liquid sludge has resulted in a cost reduction of $16.12 per ton of dry solids, or approximately $48,400 per year.

"Utilization of Liquid Sludge." By Robert C. Merz, Prof. of Civil Engineering, University of Southern Calif., Los Angeles. *Water and Sewage Works*, November, 1959.

New Type of Municipal Incinerator

Whitemarsh Township, Pa., recently constructed the nation's first "horizontal flow through" incinerator, combining it with sewage treatment to provide efficiency and economy for both. The advantages of this new type of incinerator are: 1) It provides refuse storage without requiring a bridge crane. 2) It eliminates the danger of a man accidentally falling through the charging doors into the furnaces. 3) It provides continuous feeding and burning under controlled conditions. 4) Its stack gases are scrubbed clean of fly ash; the stack is low and inconspicuous. 5) It is not expensive, in either original or operating cost. A feature of the incinerator is the fire-brick walls with water-cooling pipes embedded in them. With this water-wall furnace, it is possible to operate the incinerator intermittently and for only a few hours per day without damaging the walls through cracking. Building the incinerator adjacent to the sewage plant permits the two plants to complement each other. Treated effluent from the sewage purification plant is used as industrial water for cooling purposes and in the wet scrubber for fly ash and air pollution control. At the same time, raw sludge collected in the sewage plant is being dehydrated on vacuum filters and fed into the incinerator with normal municipal refuse. This eliminates the need for sludge digestion facilities.

"A New Type of Municipal Incinerator." By I. M. Glace, Jr. Glace & Glace, Inc. Consulting Engineers, Harrisburg, Pa. *The American City*, November, 1959.

Laying Dry Sewers in Wet Ground

Because of the soil and ground water conditions in Southeast Florida it has been essential to build watertight and economical sewers to meet the requirements of the ever-expanding population growth. Effective construction methods and the use of good equipment has made this possible in this area having an elevation ranging from only 5 to 15 feet above sea level with the ground water table fluctuating from approximately 2 to 5 feet below grade. In most cases conventional types of construction equipment may be used for trench excavation in the mixed sand and porous limestone rock soil formation. For cuts to 8 or 10 feet deep, a standard rotary-type trenching machine is very satisfactory. For deeper trenches many contractors prefer to use a backhoe, and in some cases, a dragline rig. However, one excavating contractor has devised a rotary-type trenching machine which will handle cuts to 17 feet deep and 2½ feet wide. The

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The Tale of the Commissioner's Crew...

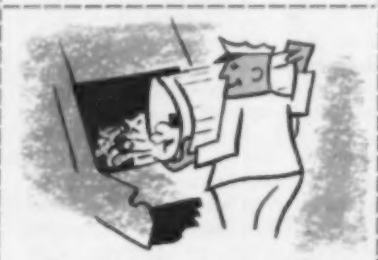
Is common with many sanitation commissioners, Commissioner Gregg was concerned over the problem of refuse collection, particularly the new city housing projects. He looked into containerization.

One of his first steps was to arrange for a Roto Pac demonstration. He was impressed. Roto Pac containerization is ideal for housing developments, institutions and commercial areas.

The reports from his crews were excellent: "Very simple to operate," "much less tiring for the operators," "fastest, easiest unit we've ever seen."

He could see for himself how much neater the Roto Pac containers were than the old accumulations of trash cans... rodent-proof, fire-proof and so much easier to keep neat too.

He found the Roto Pac to be the most efficient unit he'd ever seen. Because of its automatic continuous compaction, his crews lost no time waiting for batches to be compacted.



Of course, as Commissioner Gregg also learned, Roto Pac is the only collection truck on the market that can pick up manually dumped refuse on the same route as containers—all size containers—even the big 6 yard job.

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machine was constructed from two Caterpillar D-8's, and has proved a real boon for working in deep cuts in the porous limestone formations. With the recent development of improved joint materials, as preformed joints or inserted tubular rubber or plastic rings, the problems of constructing sewers in wet trenches have diminished considerably. Trench dewatering is often expensive and otherwise impractical. Therefore it is not uncommon for contractors to use skin divers equipped with face masks and compressed air hoses for laying pipe under water. In sizes up to 15-inch, the allowable leakage due to infiltration or exfiltration established by the Florida State Board of Health is limited to not more than 10,000 gpd per mile of pipe. Therefore leakage tests are required on all newly constructed sanitary sewage collection systems.

"Laying Dry Sewers in Wet Ground." By Richard G. Shanklin, Jr., Project Manager, Rader and Associates, Consulting Engineers. *Wastes Engineering*, November, 1959.

Other Articles

"Survey Shows Present Status of **Oxidation Ponds** and **Sewage Lagoons.**" Results of a questionnaire survey of all state sanitary engineers. PUBLIC WORKS, December, 1959.

"Studies of a Zoogleal Forming Organism Found in **Activated Sludge.**" A zoogleal forming organism has been isolated from activated sludge that materially reduces the BOD of aerated sewage. By T. C. Buck and C. E. Keefer, Research Bacteriologist, and Sewerage Engineer, Bureau of Sewers, Baltimore, Md. Sewage & Industrial Wastes, November, 1959.

"Sedimentation and Preaeration Experiments at Los Angeles." Data collected from full-scale experiments performed at the Los Angeles sewage treatment plant will be used as a guide for the design of future enlargements. By Robert J. Theroux, Project Engineer, Hyperion Engineers, and Jack M. Betz, Senior Civil Engineer, Sewage Treatment Division, Los Angeles, Calif. Sewage & Industrial Wastes, November, 1959.

"Sludge Dewatering by Vibrating Screens." When using a combination of a coarse screen, a sonic screen, a sonic filter and a roll press data is reported which shows dewatering of digested sludge to 35 to 40 percent solids. By Friedrich Kiess, Dr. Ing; and Carl Schreckegast, Chemist, Wuppertal Sanitary District, Germany. Water & Sewage Works, November, 1959.

"Ground Garbage Won't Trouble This Plant." Lincoln, Ill. sewage purification plant makes design revisions to be able to receive an unusually heavy load of ground food wastes. By C. L. Ritchie, Consulting Engineer, Crawford, Murphy & Tilly, Springfield, Ill. The American City, November, 1959.

"The Biological Control of **Enclosed Environments.**" A survey was made of the chemical, mechanical, and biological means of environmental control aboard earth satellites and other spaace vehicles. By C. G. Golueke, W. J. Oswald, and P. H. McGauhey. Sewage and Industrial Wastes, October, 1959.

"Municipal **Incinerator Selection.**" The author discusses the pros and cons of various types of new equipment used in municipal incinerators. By H. G. Meissner, P.E., PUBLIC WORKS, November, 1959.

"An Investigation of the Mechanisms of **Controlled Filtration.**" A progress report on filtration through deep filters. By W. T. Ingram. Sewage and Industrial Wastes, October, 1959.

• • •

Sales Promotion Costs for Water and Electric Departments

The annual report for the year ending Feb. 28, 1959, of the City Water, Light and Power Department of Springfield, Ill., showed sales promotion expense for the Water Department totaling $38.22 while the Electric Light and Power Department sales promotion expense amounted to $56,351.54.

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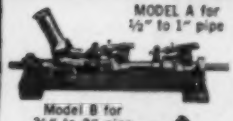

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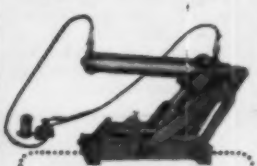

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USE OF COMPLETED SANITARY LANDFILL SITES

C. A. ROGUS

Director of Engineering,
Department of Sanitation,
New York City

IT IS A MATTER OF RECORD that over the years countless acres of landfills have been developed and built on with many types and sizes of structures. For instance, in New York City records show that since 1898 about 160 refuse fills have absorbed about 300,000,000 cubic yards of material to reclaim about 10,000 acres of tidal and marshy lands. These sites varied in area from 1 to 2700 acres each and were filled to compacted depths of 5 to 30 feet. The assessable valuation of these reclaimed lands is estimated at well over $100,000,000. A more noteworthy fact is that much of this reclaimed land has been built upon with streets, parks, airports, golf courses, industrial buildings and large housing developments. The largest and best known of these are the LaGuardia Airport and the Flushing Meadows Park, site of the 1939 World's Fair and the planned 1964 World's Fair. Notwithstanding these and many similar successful developments in other parts of the country, the subject of using completed fills is still controversial.

We will concede that construction on such fills can be hazardous, unsound and perhaps odorous if the fill itself was not properly made and if proper construction details were not followed. The old-fashioned dumps in particular have developed in many cases difficulties which have unnecessarily hampered the sound economic usage of reclaimed lands. Similarly, although many successful usages are on record, it is recognized that further research and tests are needed to supplement our present knowledge in this field.

Since fills made with ashes, construction wastes or similar inert materials pose no uncommon development problems and since fills made with garbage only are not advocated and seldom practiced, this paper concerns itself only with fills of mixed refuse—an unsegregated mixture of garbage, rubbish and ashes. The composition varies geographically, seasonally and annually but in general is comprised of about 20 percent garbage, 45 percent rubbish and 35 percent ashes (including residue, tin cans and bottles). The overall moisture content is about 20 percent. Densities vary from an average 275 lbs./cy. at the curb to about 400 lbs./cy. in the compacting type collection truck.

All fills can potentially produce or create gas emissions, odor nuisances, settlements, rodent and insect problems, fire hazards, risks of polluting potable waters and high costs of landscaping. The occurrence of these together with their extent and precise nature depends on the character of the refuse deposited, methods of deposition, nature of the underlying soils and design details of the superimposed structure. A brief appraisal of each of these potential hazards follows:

Gas Emissions: Decomposition is dependent on a suitable environment of moisture, temperature and close contact among all of the components. Within the fill proper, decomposition is of the anaerobic type. The rate depends on the amount and type of the three environmental factors available. Thus in the top 3 or 4-foot layer the putrescibles will be virtually destroyed in one to two years. Those lying deeper will decompose more slowly and perhaps not at all. It follows therefore that the probability of gas generation and emission is least in controlled fills. There the refuse is normally placed in compacted sealed layers. The top four-foot layer, because of favorable surroundings, digests rapidly, becoming stable and tight; and if undisturbed it seals off the lower layers against moisture, oxygen penetration and gas production.

Surface cracking, differential settlements and improper surface grading will reverse these conditions and gases may be generated and emitted. This possibility must be recognized and the proposed design must be tailored to suit, even on the best made fills.

Acknowledgement: This article is adapted from a paper by Mr. Rogus before the 1959 American Public Works Congress.

The following rules are suggested to alleviate explosion hazards from the possible seepage of methane gases. These rules are premised on the concept that:

1. The subsurface gases can be intercepted and dissipated harmlessly into the atmosphere through venting by means of suitably designed porous, gravel-filled trenches or by pipes inserted into the body of the fill.
2. The discharge of landfill gases into structures can be arrested by means of a sub-surface enclosing envelope of gas-tight construction.

All structures to be built on lands suspected of having been filled in, in part or in whole, with putrefiable materials should conform to the following minimum requirements:

Residences: A) No cellars, basements, crawl spaces or similar open spaces shall be permitted below finished grade. B) The ground floor shall be at least one foot above finished grade and shall be of permanently gas-tight construction. The fill immediately underneath shall be of non-porous materials to a depth of 24 inches. C) All pipes, ducts and conduits piercing the ground floor shall have gas-tight gaskets of an approved permanent nature.

Multiple Dwellings: Use any one of the following three alternates: Alternate I (same as for Residential Houses). Alternate II—Provide a three-foot high crawl space above finished grade under the entire area of building, this crawl space to be permanently ventilated through fixed louvered openings in the enclosing walls having sufficient area to provide ten changes of air per hour. The crawl space shall have gas-tight floor construction at the top and an impervious floor slab at the bottom.

Alternate III—If the structure is to have a basement or cellar, it shall conform to the following minimum requirements: 1) An approved continuous permanently gas-tight envelope shall enclose the entire outside face of the walls and the underside portion of the basement slab. 2) All pipes, ducts, and conduits piercing this protective envelope shall be equipped with gas-tight gaskets of

an approved permanent nature. 3) Provide, above grade, fixed louvered openings through the outside basement walls so as to permit at least ten changes of air per hour. 4) Install around the perimeter of the building a continuous trench, 3 feet wide by 3 feet deep, filled with gravel or similar other approved porous material.

Industrial and Commercial Buildings: The substructure construction shall comply with that specified for either Alternate II or Alternate III.

Where undecomposed or partially decomposed putrescibles are exposed, as in the construction of basements and trenches, putrefaction and release of odorous gases will take place—the degree varying largely with prevailing temperatures. Corrective measures suggested are: 1) limiting this phase of the construction to cold weather; 2) reducing the time of exposure to the absolute minimum followed by prompt reburial; and 3) spraying the exposed putrescibles with heavy dosages of oxidizing catalytic agents.

Odor Nuisances: Anaerobic fermentation within the refuse fill may not be odorous, depending on the stage of the digestion cycle. Partial decomposition releases hydrogen sulphides and other gases of a highly odorous nature. On the other hand, complete digestion produces odorless, somewhat musty but highly flammable gases, as methane. When combined in critical proportions with oxygen this gas is highly explosive.

Other Problems

After filling operations are completed, shrinkage within the fill results from the shifting of material into voids or empty spaces still left within the refuse, even after mechanical compacting; or into voids produced by decomposition of the organic materials or by the corrosion of the metals. Overall settlement may also occur because of changes in the underlying original strata.

The overall effect of all these factors is that each 3 cu. yds. of refuse in the truck finally reduces to about 1 cu. yd. in the fill. As a rule, about 90 percent of the total settlement occurs in the first two to five years. The remaining 10 percent may be of such a long range character as to have little bearing on the planned grades for the site. These settlements require local checking, occasional regradings and maintenance of the completed surfaces.

With regard to load bearing characteristics, extensive dynamic and static tests show that fresh landfills will readily support rubber tired equipment carrying in excess of 25,000 pounds per tire; well-placed and seasoned fills will safely support uniform foundation loads of the order of 2,500 psf. The corrective steps call for either a pile foundation or spread footings.

The sanitary landfill because of its essential clean earth cover is practically free of nuisances. Rodent life is discouraged by the absence of voids within the compacted fill and the inability to burrow through the 24-in. surface cover. Fly emissions from buried larvae, which might have survived the larvacide sprayings, are successfully controlled by the use of a well-compacted dense cover of 6 ins. or more in thickness.

The completed undisturbed sanitary landfill is free of fire hazards. If the fill is reopened for construction purposes and fires develop, spraying with water or smothering with a blanket of earth is the obvious solution. If deep seated fires develop they can be brought under control by rooting with bulldozers for surface exposure and spraying.

The possible pollution of surface and underground potable water is controllable in planned landfills. The usual 2 percent finished top grades prevent ponding and shed the surface water to drainage channels. More importantly, the impervious character of the top refuse layer prevents surface waters from leaching through the fill and into underground waters. Nevertheless, it is important to stress that where potential water pollution hazards exist, intensive local studies and precautions are in order. The more common preventive measures are: 1) landfill sites should be at safe distances from streams, lakes, wells and similar water sources; 2) the site should not lie above subsurface stratification of a type which leads the leachates to water sources; 3) earth cover should be near-impervious; and 4) suitable drainage trenches filled with porous gravel should lead to less hazardous discharge areas.

Surface landscaping on completed landfills requires adequate top-soiling to sustain lawns, shrubs and trees. The procurement of such top soil in rural areas poses no great economic problem. In large urban areas, short of good top soil, the problem is one of large economic proportions. In New York City for instance the Park Department, in 1950, estimated the cost of importing top soil for the then near-completed 1900 acres of landfills at $8,500,000. This cost for the programmed 5,000 additional acres of landfills would now be at least another $20,000,000. Research by consultants for the Park Department showed that hydraulically pumped sand cover could be used as a base for manufacturing artificial top soil at about 1/3 the cost of natural top soil. This process applies digested sewage sludge on top of the sand cover by spray irrigation to a depth of four inches. After drying this is disced into the sand cover by usual farming methods. This operation is repeated until an equivalent of 4 inches of dry sludge have been added. Thereafter, 3 inches of clay or other suitable earth are disced in to give the sludge and sand mixture body and water holding power.

• • •

Talking Signal Stresses Pedestrian Safety

New York City pedestrians poised for their usual street-crossing dash in defiance of traffic signals, city ordinances, and the vital statistics, were given fresh and novel pause on the morning of December 3rd. For it was then that Traffic Commissioner T. T. Wiley operated a control and the muffled voice of a new-type audio-warning apparatus at the busy corner of Fifth Ave. and 42nd St. mounted to a full-throated blare of warning. The "Talking" signal is elecrically synchronized with the visual control signals to direct pedestrians to begin crossing the streets during the "walk" period, changing to announce the beginning of the "don't walk" one, and cautioning them on the danger of jaywalking during the steady latter period. Interspersed were stentorian warnings that jaywalking was against the law and would bring a summons to offenders. Also announced were statistics pointing out that of the city's 17,500 jaywalker casualties in 1958, 2,600 were killed or injured while crossing against the red light.

The new device, still in the experimental stage, will be in force at least during the "Holiday Safety Campaign" sponsored by the Traffic Department. It is hoped thus to hold down the pedestrian mishaps which usually increase 50 percent during the Christmas holiday season.

The "Talking" signal was developed by engineers of the New York Traffic Department and the Arnold Products Co. of Brooklyn. Cost of each unit is estimated at $250.

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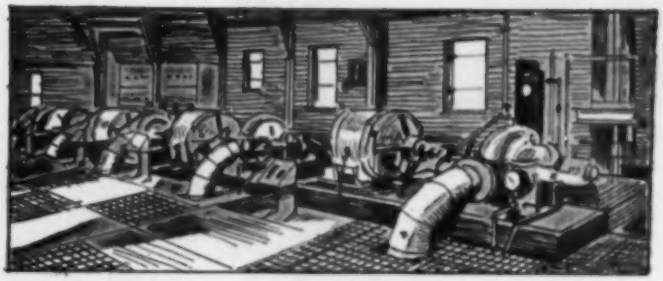


Prepared by **ALVIN R. JACOBSON, Ph. D.**

Associate Professor and Head, Division of Sanitary Science, Columbia University School of Public Health

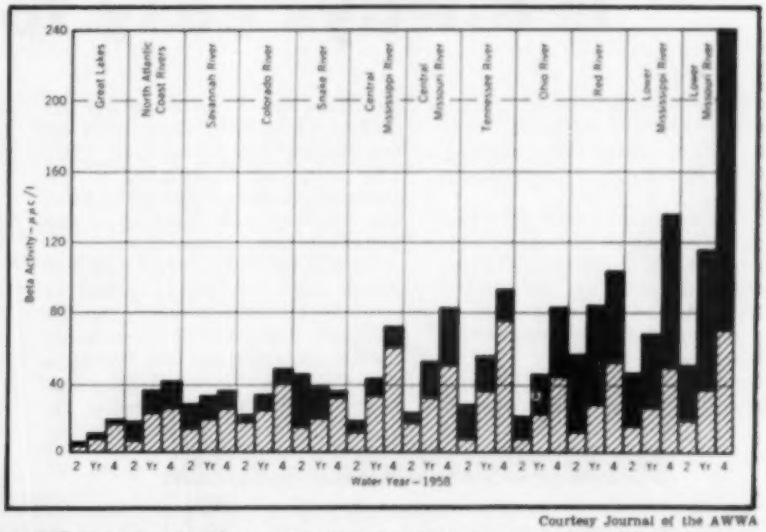
Largest "Push Button" Water Plant

Recently Philadelphia placed in operation the nation's largest "push button" water treatment plant at the Torresdale Filters. Thus was climaxed five years of construction of the city's $25-million plant which can treat 282 mgd in normal service and 423 mgd under stepped-up rates. Typical of Philadelphia's reliance on the magic of "automation" is the fact that a new microwave communication network will tie all of the water department's farflung facilities into a unified brain center. From the time the raw water of the Delaware River enters the filtration plant for preliminary chemical treatment, until it is pumped into distribution mains from underground storage reservoirs, the purification process is constantly monitored and controlled by an elaborate network of pneumatic and electronic instruments. The raw water from the river passes through 11 steps involving pumping, treatment and storage. In brief the water flows from the intake into the old mixing chamber where it is chlorinated to breakpoint residual and preliminary sedimentation is provided in the old earthen basin. The water is then pumped by the old low lift pumping station into the new pretreatment building where chemicals are applied. These chemicals may include chlorine, carbon, lime, and alum. Both the chemicals and water are thoroughly mixed in the eight rapid mixing basins and then in the four slow mixing basins. The coagulated water flows into four sedimentation basins and finally to the 94 rapid sand filters. After filtration the water is chlorinated again and receives fluoride for control of dental decay in the post-treatment building. Lime and metaphosphates may be added to reduce corrosion. The water is carried from the post-treatment building to the 50-mg clear water basin from where it is pumped into the distribution system. The functions of the control system costing more than $500,000 are described in some detail.

"America's Largest "Push-Button" Water Treatment Plant Dedicated." *Water Works Engineering*, November, 1959.

Radioactive Surface Water

Measurements of radioactivity were made on samples of water collected from 44 stations of the National Water Quality Network of the USPHS. Every week, 1-liter grab samples of surface water were collected by personnel of cooperating state and local agencies and were shipped to the Robert A. Taft Sanitary Engineering Center for determinations of gross alpha and beta radioactivity. The radioactivity measurements on the weekly samples from the principal river basins of the United States were summarized for the 11-month period ending Sept. 30, 1958. The investigations showed that insignificant increases of beta activity over normal background occurred in the period from November 1957 through March 1958, with a marked increase in activity levels in the period from April through September 1958. Peak values occurred in July. Of more than 1,500 samples, only two exceeded 800 μμc/L total activity; however, 119 suspended-solid samples were in excess of 100 μμc/L, and 61 dissolved-solid samples had activities greater than this value. Removal of much of the suspended fallout activity can be accomplished by conventional water treatment processes (coagulation and rapid sand filtration). On the other hand, these processes are quite ineffective for the removal of filtrate (dis-



Courtesy Journal of the AWWA

● **BETA activity of surface waters in various drainage areas. Striped bars represent dissolved solids; black bars, suspended solids. Numerals refer to quarters of the water year and "Yr" means average for 11 months of water year ending 9/30/58.**

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solved) radioactivity. Ingestion of radioactivity may come from drinking water and, more particularly, from eating food that may be produced in areas far removed from the point of consumption.

"Radioactivity of Surface Waters in the United States." By Floyd R. Setter, Chief; John E. Regnier, Staff Ass't to Chief; and Edward A. Diephaus, Chemist, Div. of Radiological Health, Robert A. Taft Sanitary Engineering Center, USPHS, Cincinnati, Ohio. *Journal A.W.W.A.*, November, 1959.

First City to Use Red River Water

This spring Bossier City, La., completed construction of its new water treatment plant being the first city to utilize the Red River as a source of supply. Previously Bossier City had received its water from the City of Shreveport, located just across the Red River. The treatment plant receives the raw water from the river channel through about 1,200 ft. of 24-inch cast iron pipe. After primary treatment in the two 4 mgd accelerator upflow basins, including coagulation, softening and sedimentation, the softened water is stabilized in a recarbonation basin. A 30-inch cast iron pipe conveys the recarbonated water to the three 2-mgd filters. Filtered water flows by gravity to a 2-mg clearwell. Generally the characteristics of the raw river water vary widely. Chemicals used include ferrous sulfate for coagulation at the high pH ranges resulting from the coagulation process; hydrated lime and soda ash for softening; and chlorine for disinfecting. During certain periods of high turbidity activated silica is applied as a coagulant aid. Future plans call for additional mains and storage capacity. Plant capacity can be increased from 6 mgd to 8 mgd by equipping the fourth filter which was installed but not equipped.

"First City To Use Red River Water". By B. M. Ferguson of Demoupulos & Ferguson, consulting engineers, Shreveport, La. *The American City*, November, 1959.

Alliance Plans

To ensure an adequate water supply for the present and future domestic and industrial needs of the City of Alliance, Ohio, advance planning has been found to be an absolute necessity. Proper development of the Alliance area can be accomplished only through planning and cooperation between the City of Alliance and the three surrounding counties, i.e., Stark, Mahoning and Columbiana. Such a plan will benefit the city through orderly development and lower unit cost of treatment. As part of this plan the sewage treatment plant is being remodeled and enlarged and additions to the water system are being completed. The water project involved the laying of reinforcing water mains, the construction of a new standpipe and revamping of one settling basin by installing mixing and sludge removal equipment. The completion of the water mains has provided adequate capacity from the plant making it possible to maintain a higher water level in the reservoir. With the installation of the new discharge line from the pumping station and an additional flow nozzle, a new Builders-Providence panel board was installed to provide better control over the plant operating units. To maintain proper pressure and flow in an area some 200 feet higher in elevation than the pumping station, a new half million gallon steel standpipe was constructed. The interior of this tank—which is 96 feet in height

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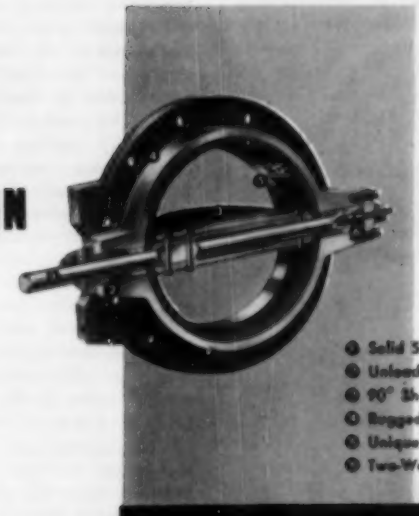

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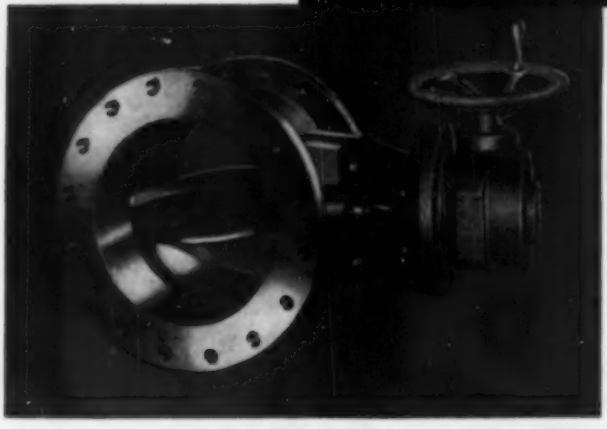

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and 30 feet in diameter — was painted with Inertol black and the exterior with Inertol aluminum. The third part of the present water project involved alterations to one settling basin. The 60 x 100-ft. settling basin was converted into a Walker Process upflow rectangular clarifier. Chemicals are added to the raw water at the chemical building. The water flows through an open flume to the reaction zone which is equipped with four vertical shaft mixing units. Six flights of sludge scrapers sweep the sludge to the center and two screw conveyors carry it to the center drain where it is withdrawn at timed intervals by means of an automatic valve.

"Planned Program of Development Meets Growing Water Needs." By Donald D. Heffelfinger, Engineer-Superintendent, Dept. of Water & Sewage, Alliance, Ohio. PUBLIC WORKS, December, 1959.

Filter Design— Review

The author has provided a historical review of the various aspects of filter bed designs and methods of washing the filters. The early operation of rapid sand filters was marked by many difficulties, among them the clogging of filter beds and the mounding of gravel. At one time the cause of the difficulties of filter operation was attributed to poor distribution of the wash water. Attempts to prevent the movement of gravel by the use of wire holding-down screens were not successful. A surface wash system was developed to prevent mudball formation and clogged areas. Attempts to eliminate mounding in filter beds by replacing gravel with materials of higher specific gravity were unsuccessful and costly. A modification of gravel grading in filter beds has been effective in small experimental units. In the Chicago South District Filtration Plant, one large filter equipped with regraded gravel has been used for the past several months. Since the early part of 1959, experiments have been conducted with a new arrangement of the gravel layers in a filter. All of the sand and gravel was removed from a plant size filter, and the bed reconstructed in accordance with a new plan of gravel arrangement. The gravel bed is at first built up from coarse to fine layers as usual, except that some of the layers are shallower. After the layer of smallest gravel is installed, layers of coarser gravel are placed over it. This filter has functioned satisfactorily since the gravel was regraded. No difficulty from gravel movement is anticipated.

"Review of Filter Bed Design and Methods of Washing." By John R. Baylis, Engr. of Water Purification, Dept. of Water & Sewers, Chicago, Ill. *Journal A.W.W.A.*, November, 1959.

One Dollar Per 1,000 Gallons

In order to convert sea water to fresh water at a cost of $1 per 1,000 gallons, it will be necessary to use a combination of multi-effect or multi-stage flash plants and electric power plants. To obtain water at this cost it will be necessary to consider the water as a by-product of electric power. The author has listed the cost figures for a plant able to deliver 1,000,000 gallons per day combined with a 5,500-kw electric load. The costs included are complete. Investment includes transportation, insurance, erection, water storage, interest on capital during construction, engineering, contingencies, and site. Annual costs

THE POPULATION BOMB

Economists and scientists refer to a rapid increase in the number of people as a "population explosion." U. S. population today is estimated at around 175 million and is increasing at the rate of about 7,500 each day—a new citizen every 12 seconds. Census experts expect U. S. population will be 250 million by the 1980's.

The basis of increased water use is an increase in consumers plus greater consumption per capita. U. S. is experiencing both. Total water use in the U. S. in 1900 was about 35 billion gpd. By 1950 it had increased to 200 billion, in 1959 it is 300 billion, and by 1975 it is expected to be well over 400 billion gpd.

A local water problem may involve insufficient quantity, poor quality and inadequate distribution. Federal, state and local officials and your water works superintendent know what to do. But they cannot do it without wholehearted public support.

This series is an attempt to put into words some appreciation of the water works men of the United States.

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include a 20-yr. amortization, 4% interest on investment and working capital, all maintenance, labor, supplies, fuel, power, taxes and insurance. Under current conditions the cost would be about $1 per 1,000 gallons but with a new demonstration unit, to be operated in conjunction with existing steam-generating facilities at Southern California's Mandalay Steam Station, it is hoped that the cost will be lowered somewhat. The engineers plan to utilize a new principle in the distillation equipment for this application. The development, under study for several years, greatly reduces the required heat-transfer surface and pumping power, important cost factors. The author states, however, that there appears to be no factual evidence today which suggests that a price below $100 per acre foot, if all costs are considered, will be attained in the near future. For costs lower than this, the process must ultimately be one where some "free" natural energy and facilities can be largely employed. Cloud seeding would be one such process.

"One Dollar Per 1,000 Gallons." By Fred A. Loebel, Pres., Cleaver-Brooks Special Products, Inc., Waukesha, Wisc. *The American City*, November, 1959.

Other Articles

"Influence Des Matieres **Radioactives Sur Les Eaux.**" Rapport du sous-comite des substances radio-actives de la British Waterworks Association, sous la presidence du Dr. E. Windle Taylor. La Technique De L'eau, 15 September, 1959.

"Regional **Water Supply Systems.**" A joint discussion presented at the Annual Conference of the AWWA at San Francisco, Calif., in which the following participated: W. W. DeBerard, Deputy Comr. for Water & Chief Water Engr., Chicago, Ill., J. W. McFarland, Gen. Mgr., East Bay Munic. Utility Dist., Oakland, Calif. Journal A.W.W.A., November, 1959.

"Long-Range **Weather Forecasting** as a Water Supply Tool." This article outlines procedures for forecasting the sequence of precipitation and temperature during a water year and for conversion to "dependable" streamflows. By Irving P. Krick, Pres., Irving P. Krick Associates, Denver, Colo. Journal A.W.W.A., November, 1959.

"Old and New Procedures in **Water Coagulation.**" A brief review of the chemical action of coagulants commonly used in clarification and softening together with a discussion in greater detail of the more recent developments in the field of aids to coagulation. By Christopher P. Blakeley, Chemical Products Engineer, Hagan Chemicals and Controls, Inc. PUBLIC WORKS, December, 1959.

Cleveland 80W lays pipe for 13-mile sewer line—does backfilling, too

G. C. McLeod Co. of Edmonton, Alberta made extensive use of its Cleveland 80W for laying 20" and 8" asbestos pipe on a 69,000-foot sanitary sewer line in Nanaimo, B. C. Even in the extremely wet and heavy mud of the salt water tidelands shown above, construction moved ahead 800—1,300 feet daily. As the line progressed into drier ground, the 80W was further employed in backfilling and cleanup operations.

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Comments on the Commentary:

Are Filter Rate Controllers Necessary?

M. E. ROGERS,
Manager, Utilities Sales,
B-I-F Industries, Inc.

THE October issue of PUBLIC WORKS contains a very interesting commentary by R. S. Rankin, who raises some pertinent points on the future of filter design and operation. As a representative of a manufacturer of filter rate controllers, I am particularly interested in the ultimate answer to Mr. Rankin's question "Are Filter Rate Controllers Necessary?"

I'd like to make some comments on the subject, but I wish to make it clear that it is not my intention to defend filter rate controllers simply because my company manufactures them. My position and that of my company, is that consulting engineers should design filters to produce the results desired, with or without filter rate controllers. We, as manufacturers, are prepared to furnish the instrumentation and control devices necessary for operation.

I believe Mr. Rankin has put his finger on a pertinent point when he says: "Before abandoning all controllers, it is worth reviewing the evidence to see what course to follow." With reference to present evidence available, it seems we should recognize that neither Hudson nor Baylis was the first to design or operate filters without rate controllers, as each would be quick to agree, although perhaps Hudson may have been the first really to champion the idea.

Operation Without Controllers

Many years ago, Allen Hazen, at Catskill, New York; Larchmont, New York; Danville, Virginia; and Rahway, New Jersey, omitted filter effluent controllers; the filters on each side of the pipe gallery were manifolded into a common header, with a single Venturi tube in each header. Flow of water through the filters was regulated by manipulating the filter effluent valves or by a float controlled valve riding on the surface of the filtered water reservoir.(2)

Charles P. Hoover, at Columbus, Ohio, designed a plant about 1950, in which filter effluent controllers were omitted. The flow through the filters was regulated by a centrifugal pump, which pumped against a fixed head in an elevated tank nearby. Both the tank and the pumping arrangement floated on the system and in effect constant rate filtration was achieved.

In October, 1951 (1), Easterday reported how he had operated 20 filters in St. Louis, by propping open the filter rate controllers or by removing them entirely from the filter effluent line. In 1953, the Central Plant of the St. Louis County Water Company was expanded on a variable rate design, with rate controllers set at a maximum of 4 gpm/sq. ft. In order to prevent the filters from running away, the filtered water reservoir was raised so that during periods of low demand, there was only about 4 ft. difference in head between the filters and the clear well. When high demand lowered the clear well, the filter rates increased accordingly. Easterday proposed further some sort of restriction in the filter effluent lines (possibly a partially throttled effluent valve) to prevent a clean filter from running away at times when the clear well was low. This is roughly the identical manner in which old, slow sand filters were operated.

N. E. Jackson reported in 1955 (3) on experiments at the Dalecarlia Plant in Washington, D.C., where he operated without benefit of rate controllers for several months. Besides these controlled studies, there are many cases throughout the country where rate controllers do not function because of neglect or where the throttling mechanism has been removed to increase the capacity of the filters. In such cases, the loss-of-head through the filter beds is relatively constant and the throughput declines as the filter gets dirty. Such plants are, in effect, operating on the variable rate principle, but the fact that they are so operating does not furnish *prima facie* evidence that rate controllers are unnecessary.

T. M. Riddick (4) has designed several filter plants which do not employ rate-of-flow controllers in the conventional sense. In the Riddick design, the rate of effluent flow is regulated by a butterfly valve, operated from a float riding on the surface of the water above the filter. The flow rate is fairly constant and in this respect differs from the Hudson and Easterday concept.

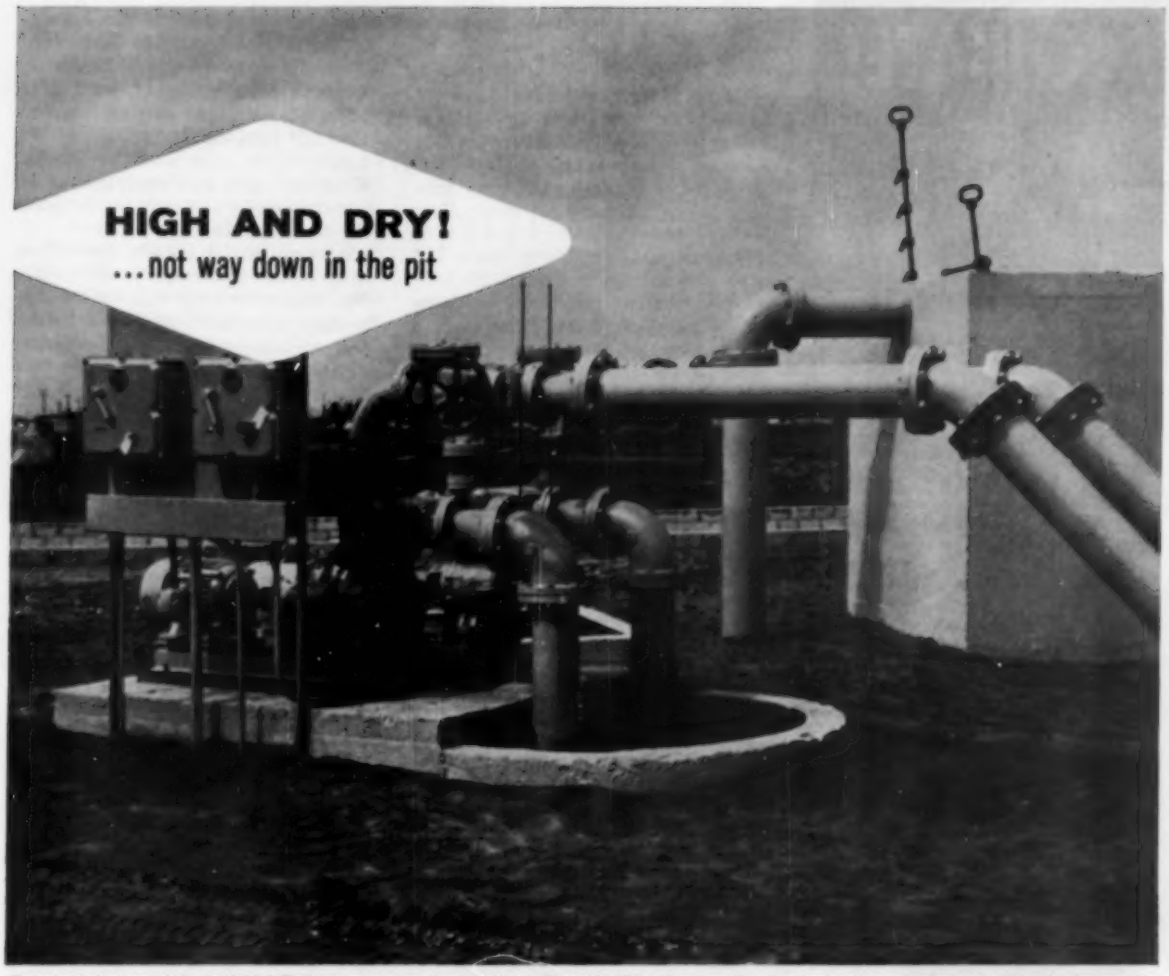
It is not my intent to dim the luster of Hudson's proposal, for he has devled into theories not previously propounded, and he is to be commended. I mention these previous ideas of similar nature to point out that they have not had much influence on standard practice. Also, in every instance, including Hudson's, either some special design of filter and clear well relationship with respect to head difference was part of the arrangement, or some means of controlling flow was provided by effluent valve operation (manually or otherwise).

Filter Production

With respect to results obtained, Jackson's (3) experiments at Washington indicated more water could be produced between washes if the filter was operated "at reduced initial rates" or as he expressed it in his conclusions, above 4 gpm "initial head losses are excessive even in anthracite media, causing deep penetration of the bed by suspended matter and leading to early reduction of flow."

The Baylis data (7½ months study) (5) do show that filters without controllers passed 5.09 million gallons between washes, while filters with controllers passed only 3.28 million gallons between washes. This difference appears to be in favor of variable rate filtration but such a direct comparizon is valid only if both sets of filters were operating, either at the same average rates, or to the same end point in terms of terminal head loss. Unless such conditions did obtain, this difference in volume of water filtered between washes cannot be taken as proof that variable rate filtration is better. More information is needed on this point.

Baylis' filters with rate controllers had an average effluent turbidity of 0.0032 mg/L, whereas the filters



Twin installation of Model 14A2-B at a sewage treatment plant, Clair-Mel City, Tampa, Fla. Controls alternate pumps at regular intervals.

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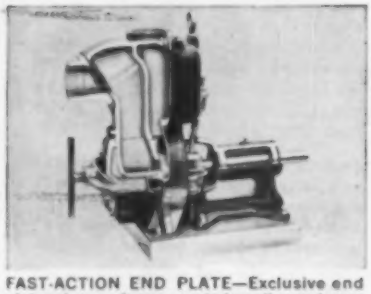

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without rate controllers produced water with an average turbidity of 0.0044 mg/L. These data indicate water of 37 percent less turbidity by constant rate than by variable rate filters. More important than this average difference is the fact that the number of days with zero turbidity was 185 without controllers and 189 with controllers, and out of 2666 individual turbidity tests (12 daily on each set of filters), 92 percent showed no difference between the two sets of filters. (The other 8 percent of the time must have accounted for the average difference noted.) Based on these turbidity tests, it seems logical to conclude, at least for these extremely low turbidities, that the matter of turbidity in the effluent has no importance in the choice of variable versus constant rate filtration.

Mr. Baylis has indicated that variable rate filtration destroys some of the flexibility of operation which he enjoys with his rate controlled filters, and he has not indicated that he intends to remove the filter rate controllers. Furthermore, without controllers, an operator cannot control the flow of his own desires; he cannot, for example, operate at a low rate after washing to permit an accumulation on the sand surface and prevent its penetration into the filter proper where it would cut down the length of filter run.

Hudson (6) presents data on 12 months of operation with variable rate filtration at Wyandotte, Michigan, representing two periods of study (September to May and June to August). The data reported are shown in Table 1.

According to these data by Hudson, variable rate filtration is better (more so in the summer months), but here again the filters were not operated at the same average rate of flow and the terminal rate of flow at a head loss of approximately 5 ft., ranged from 2.21 to 2.09 gpm/sq. ft. It is also noted that Hudson's average rates was less than 25 percent above the standard rate of 2 gpm/sq. ft. and the maximum initial rate under his variable rate program was only 2.65 gpm/sq. ft., well below the 4 gpm/sq. ft. rate used by Baylis. Would variable rate operation at an initial rate of 4 or 5 gpm/sq. ft. show the same results?

As with Baylis' results, the difference in the extremely low turbidities (approximately 0.1 mg/L), although favoring variable rate filtration in this instance, hardly seems significant. Only in respect to length of filter run and total water filtered, in the summer, do the data seem to be significantly in favor of variable rate filtration.

It is not my intent to say that Hudson's conclusions are wrong or that variable rate filtration should not be tried or adopted, but I do think that filter rate controllers should not be declared unnecessary solely on the basis of studies that have been reported to date. I believe that a definitive and critical evaluation should be made of filter rate controllers and I suggest that such studies should include both university research and in-plant studies of many types of plants in various parts of the country.

Orifice Plates

One other point: Mr. Rankin mentioned the possibility of using an orifice plate to serve as a measuring device to replace the Venturi tube. I believe orifice plates were used at the Wayne County plant to limit maximum flows. I believe there are many good and valid reasons why orifice plates are not satisfactory for this service. For example, orifice plates require greater installation space for proper operation, than does a Venturi installation. Furthermore, an orifice presents a dam in the flow stream, a place where sand can accumulate and interfere with

Table 1—Hudson's Data, Variable vs. Constant Rate Filtration

	Average Filter Runs Hours	Effluent Turbidity mg/L	Filtration Rate gpm/sf	Total Filtered gals./sf/run
September to May				
Variable Rate	28.0	0.083	2.43	4090
Constant Rate	26.6	0.106	2.36	3780
June to August				
Variable Rate	36.0	0.105	2.37	5100
Constant Rate	25.5	0.121	2.2	3360

proper measuring by the orifice. An orifice plate introduces four to five times the head loss introduced by a Venturi tube. This head loss necessitates either that the clear well filter elevation relationship must provide greater head difference to allow for that head loss. This factor may result in increased power costs for pumping. Recent plant designs have been worked out using the Dall flow tube in place of the Venturi tube with a reduction in head loss from that of the Venturi tube by as much as half, and the Dall flow tube has a shorter laying length than the Venturi tube. The only disadvantage of the Dall tube is that it requires a full line size valve in the effluent line as does the orifice plate. A full line size valve is not as good a throttling device as a smaller one and increases the initial cost.

I should like to end this letter as I began, with the statement that we believe that consulting engineers should design filter plants as they deem best for the results desired and we, as a company, are prepared to furnish the instrumentation to suit the design.

References

1. E. E. Easterday, *Water Works Engineering*, p. 473, October 1951.
2. Richard Hazen, Personal Communication.
3. Norman E. Jackson, *Jour. A.W.W.A.*, p. 129, February, 1955.
4. T. M. Riddick, *Jour. A.W.W.A.*, p. 733, August, 1952.
5. John R. Baylis, *Pure Water*, Bureau of Water, Chicago, Vol. IX, p. 86, May, 1959.
6. H. E. Hudson and George Hazey, *Water and Sewage Works*, p. 448, October, 1959

• • •

Fire Hydrant Maintenance and Inspection

The fire hydrant maintenance program in Arlington Co., Va., is a joint operation of the Water Division and the Fire Division. All fire hydrants are inspected semi-annually and flow tests have been made on all fire hydrants in the County. As a result of these inspections and the prompt completion of work to correct defects, the condition of the fire hydrants has been greatly improved.

Water Use by a Poultry Processing Plant

The poultry processing plants in Greensboro, Ala., use 7 gallons of water per chicken processed. One of the plants in that community handles more than 60,000 chickens per day.

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THE
INDUSTRIAL WASTE DIGEST

Prepared by **CLAYTON H. BILLINGS,** *Associate Editor*

Bench Techniques to Obtain Design Data

When domestic sewage is treated in the presence of industrial wastes in an aerobic biological system, continued successful operation of the system is dependent on maintaining equilibrium among a large number of variables. This requires investigation of the characteristics of wastes to be treated, and frequently it is found that treatment of the combined wastes requires units of uneconomical size. However, the presence of certain wastes may result in a composite discharge which requires units of smaller size than would normally be expected from standards applicable to domestic sewage. Specific pilot plant investigation is generally required, but in many cases laboratory-scale studies may prove a short cut. This is demonstrated by the application of a laboratory study of treatment by aeration of a mixture of domestic sewage, the effluents from two cereal factories, and separate discharges from two board mills. The laboratory apparatus employed consisted of a 55-gal. drum equipped with drilled pipes for build-up of an acclimated sludge. Precautions were taken to monitor the production of an acclimated sludge floc and to assure a complete turnover of sludge under fairly constant loading conditions. The attainment of constant BOD reduction in the supernatant was considered indicative of proper acclimation. To simulate various loading conditions, three 4-liter cylinders were used to aerate mixtures of the raw wastes, with samples withdrawn at definite time intervals. Parallel determinations of the oxygen uptake rate of the aerating mixture was made, employing a polarograph and dropping mercury electrode. Additional tests made included volume indexes. Individual 2-liter graduated cylinders were used to simulate the effects of primary sedimentation on BOD removal. Sludge stability under different loading conditions, detention times, oxygen requirements, and effect of primary sedimentation were evaluated. Statistical analysis of the data made it possible to determine the feasibility of process modifications to effect economics in design.

"Design Data for Biological Treatment of Combined Wastes." By Thomas P. Quirk, Malcolm Pirnie Engineers. *Sewage and Industrial Wastes*, November, 1959.

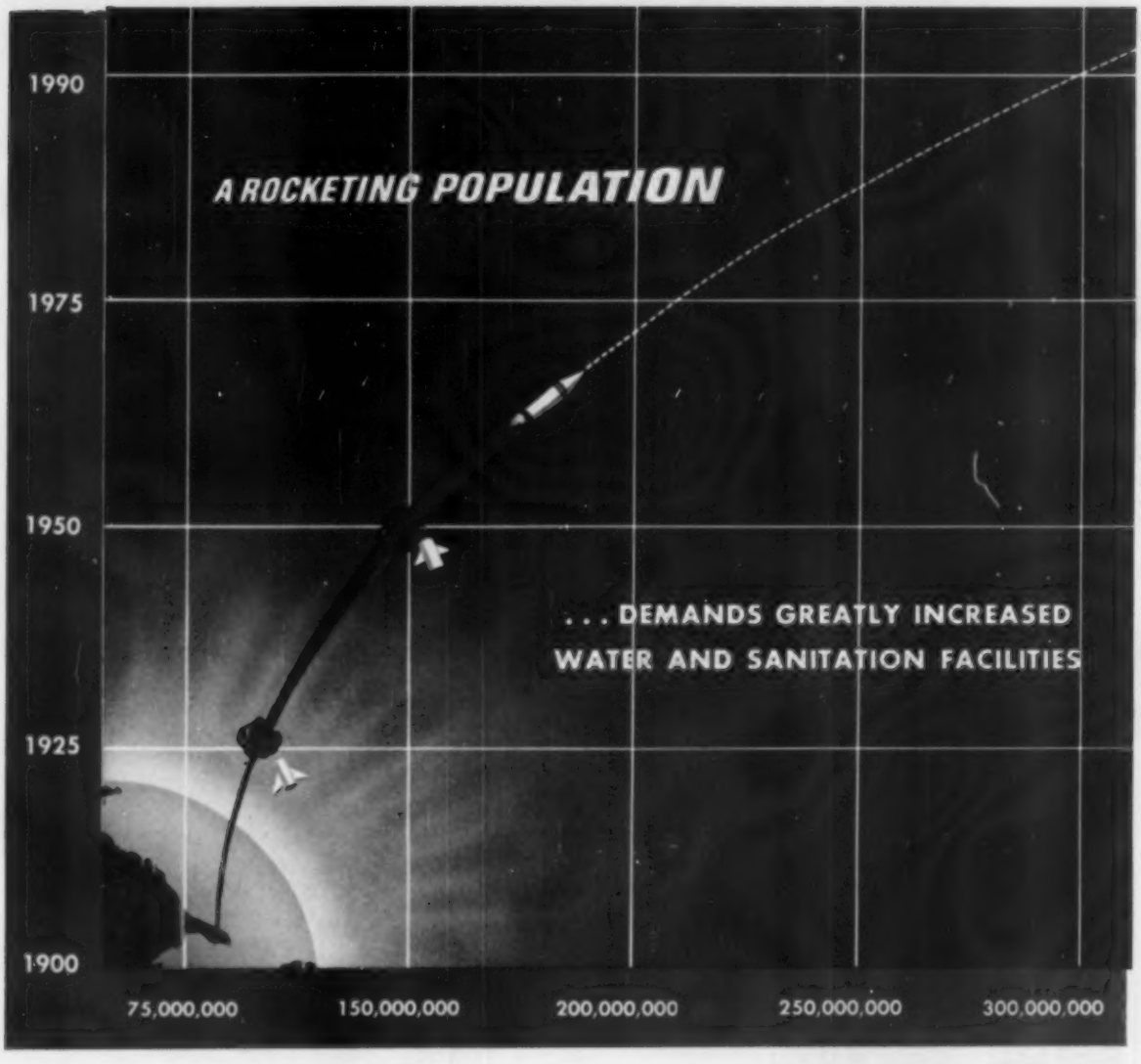
Statistical Analysis Of Air Pollution Data

In operation since 1953, the National Air Sampling Network of selected cities and nonurban areas has collected a large quantity of data concerning concentrations of suspended particulate pollutants. These data for 1953 through 1957 have been tabulated and were pub-

Rubber Pipe Used in Underwater Waste Disposal

DESIGNED to discharge processing wastes containing nitric and sulfuric acid from a large chemical plant in the southern N. J. area, a 1864-ft. length of 12-in. diameter flexible rubber pipe was laid from shore to the channel of the lower Delaware River. The Condor pipe, a product of Manhattan Rubber Division, Raybestos-Manhattan, Inc., was installed from an off-shore dredge which first scooped out a trench for it on the river bottom. Successive 50-ft. flanged lengths were bolted together, using corrosion-resistant bolts and nuts. Flexibility of the line simplified the bolting operations. The free end was lifted out of the water, without disturbing the sections already in place, and attached to the next length on the dredge. Then the dredge backed off one pipe length and dropped the newly-attached length in place. A heavy cast iron collar bolted to each rubber pipe anchored it to the bottom. The method of disposal provides for rapid dispersal of wastes by discharging them into the faster moving river channel, rather than directly offshore in shallow tidewater. Details were worked out with the Corps of Engineers who have a model of the Delaware River at their Vicksburg, Mississippi, laboratories. Although it is operated as an open-end line, the rubber pipe is designed to withstand 100 psi. A neoprene cover is used for protection against external damage, above or below water. Depending upon the tides, 50 to 80-ft. of the line could be exposed to floating debris.

● **FLEXIBLE rubber pipe for waste discharge is laid in lower Delaware River.**



Growth of U.S. Population in Millions:

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lished in November, 1958. This paper reports the results of statistical analyses of these data and additional material collected in 1958. Also, the author discusses 1) the mathematical form of the distribution of particulate levels; 2) parameters which may be used to define these distributions; and 3) the use of these descriptive parameters in drawing conclusions as to the suspended particulate pollution of the air in the United States. It was found that a plot of the cumulative frequency distribution on log-probability paper is sufficient to establish the log-normality of distribution of concentrations. It is possible to use as descriptive parameters, the geometric mean and standard geometric deviation from a plot of the decile values on log-probability paper. Geographic differences in the two parameters are apparent for non-urban stations but not for urban stations. A classification of the urban stations by the two parameters shows that 70 percent of the cities had geometric mean particulate concentrations less than 175 micrograms per cubic meter and standard geometric deviations less than 1.7.

"Particulate Pollutants in the Air of the United States." By Charles E. Zimmer, Elbert C. Tabor and Arthur C. Stern, Air Pollution Engineering Research, Robert A. Taft Sanitary Engineering Center. *Journal of the Air Pollution Control Association*, November, 1959.

Sulfur Mining Wastes

When Spindletop Dome near Beaumont, Texas, was developed, the Texas Gulf Sulfur Co. adopted monitoring and corrective measures to control hydrogen sulfide emissions. In the Frasch process of mining, superheated water is pumped into the dome to melt the sulfur, which is then lifted to the surface by compressed air. The waste water contains 600 to 800 mg/L of soluble sulfides, and the wasted air contains relatively high concentrations of hydrogen sulfide. A waste water treatment plant was constructed to convert soluble sulfides to elemental sulfur, thionates and sulfates by treatment with sulfurous acid. The insoluble materials are removed by clarification, and soluble salts are allowed to be discharged in the resulting H_2S-free effluent. A closed system is used to convey the waste water to the treatment plant where a gas separator is used to remove any entrained hydrogen sulfide. The waste air from mining and sulfur gathering operations is passed through reservoirs containing lime slurry for neutralization of the H_2S from this source. Oil operations at the site controlled by the company involved the use of oil-salt water separators, also sources of H_2S. Consequently waste water from these operations was discharged to the waste water treatment plant. A monitoring program was innaugurated to evaluate results of waste control measures. Hydrogen sulfide monitors were established at five stations throughout the adjacent residential area. These used A.I.S.I. samplers for detection of the presence of H_2S by means of lead acetate coated tapes.

"An Industrial Hydrogen Sulfide Air Pollution Control and Monitoring Program." By J. A. Monferdini and G. T. McBride, Jr., Texas Gulf Sulphur Co. *Industrial and Engineering Chemistry*, December, 1959.

Toxicity of Metallic Ions

For a number of years the Ohio Department of Health has sponsored a study of the effects of metallic ions on trickling filter and activated sludge plant performance. One of the projects involved the development of a laboratory method to predict the effects of the presence of the ions. By using the Warburg technique, the inhibition of oxygen uptake by sewage micro-organisms in the presence of various concentrations of selected ions was taken as a parameter of toxicity. A constant volume Warburg respirometer equipped with 125-ml flasks was employed. Metals investigated were chromium, nickel, zinc, copper, cadmium and cyanide. Oxygen utilization by lactose broth (simulating sewage) in the presence of the ions was determined at intervals during a period of 144 hours. Seed was provided by one milliliter of settled sewage. In all cases it was found that oxygen utilization occurred following a lag period. The rate of utilization and duration of the lag period depended upon the concentration of the ions. This indicated that sewage microorganisms have an ability to recover their oxidative capacity even in the presence of a constant concentration of a toxic ion.

"Toxic Effects of Metallic Ions on Sewage Microorganisms." By G. W. Malaney, W. D. Sheets and R. Quillin, Water Resources Center, Ohio State University. *Sewage and Industrial Wastes*, November, 1959.

"it's true; now "K&M" offers one-stop shopping for both asbestos-cement and plastic pipe!"

"K&M" adds 4 types of plastic pipe to its quality line of Asbestos-Cement Pipe! No need any more to buy quality Asbestos-Cement Pipe from "K&M" . . . and then expend time and energy shopping for Plastic Pipe elsewhere. Now, it's as easy as shopping in a supermarket! Get both types of pipe from the source you've always been able to rely on: "K&M"! But, that's not all! You can also simplify planning by fitting both "K&M" Asbestos-Cement and "K&M" Plastic Pipe into the same system . . . custom-tailoring it to your design and your budget requirements. You can get tough, thrifty "K&M" Plastic Pipe and Fittings at all "K&M" factory locations.

Write today for these informative and illustrated brochures . . . packed with facts on each type of new "K&M" Plastic Pipe!

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New (MB) Pacemaker 88 Line Marker mounts on Jeep or any light duty truck!

- Fast highway speed between jobs
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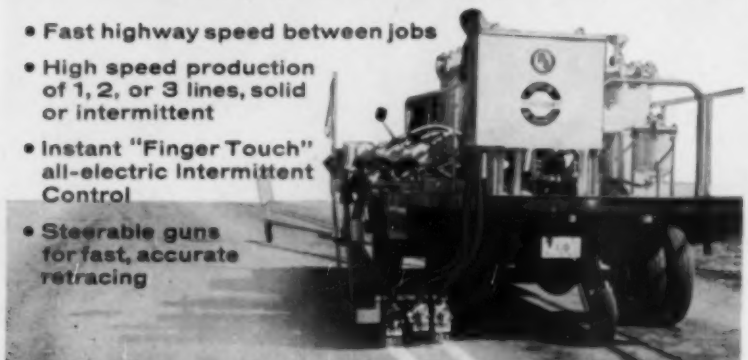

Here's a big striper with the versatility to mark centerlines, or centerlines and edge stripes simultaneously. Fast and maneuverable, the low-cost M-B Pacemaker 88 includes an adjustable guide pole and caster wheel, air lift of outrigger guns, positive reflective bead control, plus many more exclusive features. Note full-vision, high, safe position of operator.

Send for information on the complete line of M-B markers, including custom designed heavy duty models specifically designed for your use that are comparable in price to "assembly line" machines. M-B Corp., New Holstein, Wis.

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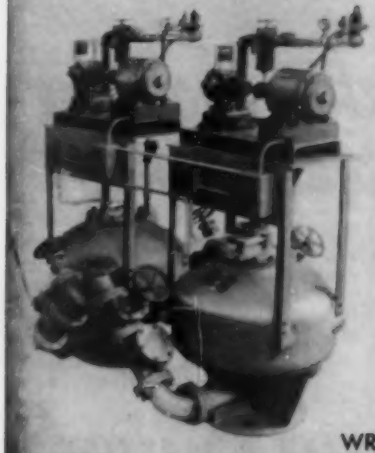
NEW HOLSTEIN, WIS.
PACKER BODIES • LINE MARKERS • SWEEPERS

KOMLINE-SANDERSON PNEUMATIC SEWAGE EJECTOR SYSTEMS PROVIDE:



ASSURANCE—of carefully designed equipment, ruggedly constructed to give exceptionally long life and maintenance-free service.

ACCEPTANCE—of Komline-Sanderson Ejectors by more and more municipalities proves their worth

APPROVAL—of design application and components of ejectors by prominent consulting engineers insures your satisfaction.

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KOMLINE-SANDERSON ENGINEERING CORPORATION

101 Holland Avenue, Peapack, New Jersey

Guides to Understanding City-Industry Problems

The handling of combined sewage and industrial wastes in a treatment plant is not as well understood as the complete treatment of industrial wastes at a company facility. While generally the combined approach is the more economical one for the entire community, there are two big stumbling blocks in effecting agreement. These are: 1) Developing an equitable service charge rate and 2) determining the effluent specifications which the industry must meet. The service charge problem may be solved by the use of sound engineering and accounting principles. On the question of effluent specifications, cities have a tendency to be too restrictive for the purpose of simplifying administrative procedure. Ordinances should have two sets of specifications: 1) One should protect the system from corrosion, clogging, formation of gases and other hazards; 2) the other should be designed to protect the treatment plant. Industrial wastes treatment has lagged behind progress in handling domestic wastes. More money should be spent to protect the water resources we now have, to avoid greater expenditures for developing additional resources and for providing a greater degree of water treatment.

"Industries and Cities Must Work Together." By Kenneth S. Watson, Consultant, Water Management and Waste Control, General Electric Company. *Sewage and Industrial Wastes*, November, 1959.

Municipal Industrial Waste Survey

Operating problems at the Grand Rapids, Mich., activated sludge treatment plant were suspected as resulting from toxic metal ions. To determine the sources, a survey was undertaken with the joint assistance of the city engineer and treatment plant superintendent. This was begun by sending a questionnaire to 780 industries. Concurrently, a survey crew began sampling the system, starting with trunk lines and progressively delineating troublesome zones with respect to concentrations in excess of 0.5 mg/L of cyanide, copper, nickel or hexavalent chromium. The coordination of sampling results with questionnaire returns identified 30 industries as potential contributors of toxic metals. This was followed by more intensive sampling at each problem industry. After sufficient data were

collected, a meeting was held with representatives of the industries. The industries were asked to review their operations to determine the sources of objectionable wastes, and limitations on the concentrations of specific metallic ions to be discharged were recommended. It is intended to give industry a reasonable period to make its own efforts to contribute to the solution of the problem.

"Tracking Industrial Wastes." By Doris Voshel, Chief Chemist, Sewage Treatment Plant, Grand Rapids, Mich. *Sewage and Industrial Wastes*, November, 1959.

Other Articles

"Oil Refinery Waste Treatment in Kansas." By Carl F. Hodgkinson, Chief Water Pollution Control Section, Kansas State Board of Health. A basin-wide approach to pollution abatement has resulted in significant progress. Sewage and Industrial Wastes, November, 1959.

"Rhode Island: Industrial Wastes Treatment." By Walter J. Shea, Chief, Div. of Sanitary Engineering. Wastes Engineering, November, 1959.

"South Dakota: **Combined Sewage-Industrial** Wastes." By Charles E. Carl, Director, Div. of Sanitary Engineering. Wastes Engineering, November, 1959.

"An Automatic **Atmospheric Fluoride Analyzer.**" By Donald F. Adams, Robert K. Koppe, and Homer J. Dana, State College of Washington. A versatile, dosimeter-type instrument was designed which has potential application for automatic determination of any pollutant for which there is a colorimetric analytical method; and which records the time required to accumulate standard concentrations of a given pollutant. Journal of the Air Pollution Control Association, November, 1959.

• • •

Skin Divers Check Gaslifter Performance

Scuba (self contained underwater breathing apparatus) was utilized recently to check circulation currents of the Walker Process Gaslifter, 70-ft. dia. digester circulator-mixer at the new Westside sewage treatment plant, Corpus Christi, Texas. The digester was filled with water while skin diver J. D. Walker, President of Walker Process, and an assistant performed the tests. Current velocities and circulation patterns were traced and measured by puffs of dye created by squirting white casein paint from a plastic ketchup dispenser. The use of underwater equipment provided the ideal opportunity for exceptionally accurate measurements from which performance of the unit under full scale conditions could be plotted.

CUT 20" CAST IRON PIPE
in Less Than 8 Minutes...

...with the New REED
ROTARY CUTTERS
(4 sizes cover the range from 10" cast iron to 24" steel pipe)

These one-man Reed Rotary Cutters cut large diameter steel or cast iron pipe *faster and better than the heaviest power machines* . . . and without electrical or explosive hazards. What's more, there's less digging in ditch-work! You need only a 4" to 6" channel under the pipe and a 45° to 60° arc for the handle swing. Reed Rotaries are easy to "carry in", too. The 20" size weighs only 68 pounds; separates into 3 easily carried parts. Patented pipe guide assures clean, right-angle cuts. Four razor blade wheels track perfectly, cut easily and are quickly interchangeable for steel or cast iron pipe.

• Write today for descriptive literature.

These typical cuts on 12, 16, 20 and 24" cast iron pipe illustrate the clean, accurate, right-angle cuts provided by Reed Rotary Cutters.

REED MANUFACTURING COMPANY
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Municipal Power

Lightning Arrester Applications

BRUCE J. ENNIS
Principal Engineer,
Burns and McDonnell Engineering Co.,
Kansas City, Missouri

LIGHTNING arresters are devices designed to protect motor and generator windings, substation and distribution transformer coils, oil circuit breakers and other station equipment against damage from lightning flashover and other high voltages that would otherwise be impressed on such equipment through exposed overhead circuits. In view of the considerable investment in such equipment, and the basic criterion of electric systems for maximum continuity of service, it is important to apply lightning arresters having suitable characteristics and properly installed on a given system to afford optimum protection against equipment failure and interruption of service.

Fundamentally, a lightning arrester is a device consisting of a series of spark gaps together with a valve-action material enclosed in a porcelain insulating housing. Connected from a phase conductor to ground, the series gaps flash-over at the instant a high voltage impulse traveling wave reaches the arrester terminals and drain the resultant current to ground, thus reducing the voltage stress on the protected equipment terminals to a value below the impulse or puncture strength of the coils, windings, and other parts of the equipment being protected. Following the passage of the impulse current, the power frequency follow-through current is extinguished by the valve-action material at the end of the half-cycle on which the surge occurs. The arrester is then restored to normal condition, ready to protect against subsequent surge voltages.

Obviously, the greater the capacity of the arrester to drain off surge currents, and the greater the ability of the arrester to reduce crest voltages, the better will be the degree of protection rendered by the arrester. Therefore, important pieces of equipment such as generator windings, large substation transformer coils, etc. should be protected with station type lightning arresters, which are designed with large gap areas, and high capacity molded valve-action materials such as silicon carbide, thyrite, and the like. Other items of equipment, such as distribution transformers, should be protected with less expensive line type lightning arresters, which are constructed with smaller series gaps and molded, pellet type, or the equivalent, valve-action material.

In any application of lightning arresters, it is necessary to provide a short, low impedance ground connection from the arrester neutral terminal to a low resistance ground in order to reduce to the minimum the I R drop through the arrester-ground-connection path and thus reduce voltage stress on protected equipment. Any choking effect on the free flow of arrester discharge current will reduce the protective effect on the arrester. As an example, a certain municipality experienced damage in the windings of an outlying 2400 volt pumping station motor following severe lightning storms, even though the motor terminals, which were connected through a high voltage starter to an exposed overhead distribution circuit, were, supposedly, protected by lightning arresters. In this instance, an insulated ground lead from the arresters was enclosed on the outside of the pump house wall in a section of thin-wall steel conduit, for mechanical protection of the lead connecting the arrester ground terminals to the earth driven ground rods. In effect, the encircling steel conduit acted as a choke coil on the ground lead, presenting a high impedance to the flow of high frequency lightning discharge surge currents, preventing the rapid discharge of these currents, and impressing high voltage on the motor windings to the point of failure. Upon realization and discovery of this condition, subsequent trouble and damage were prevented by removing the steel conduit and substituting wood moulding for mechanical protection of the ground lead on the building wall, thus eliminating the previous choking effect.

The impulse strength of generator and motor windings is generally lower than that of liquid immersed transformer coils. The insulation in rotating machines is dry and space between coils and iron is limited; therefore it is necessary to provide an especially high degree of protection against voltage stresses between the conductors and the machine iron, and between the conductor turn-to-turn insulation on the windings.

Since lightning discharge impressed voltages travel along exposed circuit conductors with a steep front (or rapid rise of thousands of volts within a few micro seconds) it is necessary to flatten out this wave front to reduce the difference in potential between turns in the machine winding and thus prevent puncture of the insulation between adjacent turns. The flattening out process is provided by connecting static capacitors to the machine terminals, thus providing a series capacitance-inductance path to dampen out the steep wave front.

To reduce voltage stresses between the winding conductors and the machine iron, specially rated station type lightning arresters are connected to the machine terminals to drain off surge currents as described hereinbefore. To further reduce the stress of incoming surge voltage waves, especially for machines connected directly to exposed overhead distribution lines, it is common practice to install line type lightning arresters out on the incoming lines at a distance of 1500 feet, more or less, from the station, and, as protection against direct lightning strokes, the incoming line circuits should be provided with overhead shield or static wires for a distance of approximately 2000 feet from the station.

For maximum protection of substation transformers, station type lightning arresters should be used, and these should be installed as closely as practicable to the transformer terminals to prevent voltage stress build-up that might result due to reflection of the incoming surge voltage wave from the high impedance of the transformer wind-

ings. In addition, it is generally the practice to install the less expensive line type lightning arresters at the point where incoming overhead line circuits connect to the substation structure, thus affording protection for other substation equipment such as oil circuit breakers, bus support insulators, potential transformers, disconnect and load break switches, etc.

It is apparent, that the theory and practice of lightning arrester application presents a problem which is both technical and economic in nature. Obviously, high capacity station type lightning arresters of proper voltage characteristics would afford the maximum protection, if used throughout the electric system; however, such an arrester could not justifiably be applied in the protection of a small distribution transformer which might cost less than the arrester, itself. In the latter case, the optimum selection would indicate the use of a relatively inexpensive line type lightning arrester for adequate protection at minimum cost.

Major manufacturers of lightning arrester protective equipment publish catalog data, and descriptive and application information covering all facets of electric system protection against damage from high voltage surge currents. For systems which have experienced excessive equipment failure or service interruptions from lightning disturbances, the solution to such problems may be found in such data.

• • •

Louisiana Water & Sewerage Short Course

The Annual Short Course, the 23rd, for superintendents and operators of Water and Sewerage Systems, will be held at Louisiana State University, Baton Rouge 3, La., March 16-18. More data from Dean Fred H. Fenn, College of Engineering.

Research in Air Pollution

The American Society of Mechanical Engineers Task Group on Research in Air Pollution is sending out questionnaires to complete an inventory of research projects and the names of the researchers. However, it is felt that all personnel engaged in air pollution research will not be reached. Interested personnel who have not received a questionnaire should communicate with Austin Heller, Chairman, Air Pollution Research, ASME, 29 West 39th St., New York 18, N. Y.

BRUSH DISPOSAL CREWS OPERATE FULL TIME WITH THE TROUBLE-FREE FITCHBURG CHIPPER

CITY

This low-maintenance Fitchburg Chipper is disposing of brush in the City of Holland, Michigan.

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"Our Fitchburg Chipper consolidates the bulk, thereby lessening dumping operations. It requires minimum maintenance and manpower."

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State of Rhode Island

TREE COMPANY

"We have never had one (Fitchburg Chipper) wear out, or give excessive trouble." Chipper still operating after 9 years.

Davey Tree Surgery Co. Ltd.
San Francisco, Calif.

UTILITY

"Our men have been particularly pleased with their Fitchburg Chippers . . . they are rugged and reliable."

Rockland Light & Power Company
Nyack, New York

When crews go out to trim trees, it's costly to have machine breakdown. That's why foresters, park superintendents, line clearing supervisors, and tree companies prefer the Fitchburg Chipper. This well-engineered brush chipper is designed for busy, trouble-free service, no down-time.

The rugged Fitchburg Chipper requires little upkeep, and has low maintenance cost. It's economical to operate. And crews like the exclusive spring-activated feed plate which adjusts itself automatically to any size brush up to its rated capacity. This patented feed-plate provides protection from damage from foreign materials, makes for greater crew safety.

The Fitchburg Chipper is engineered to work fast, safely, and to be always "ready to go." It's the chipper which won't slow down your crews, lets you plan their work intelligently—saves you time and money.

Please send in the coupon for more information, and for copies of articles on chipping which appeared recently in leading publications. These feature articles describe five methods of brush disposal and ten new ways to utilize "by-product" chips. Send for your copies, they are well worthwhile.

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FITCHBURG, MASS.

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Dept. PW-61, Fitchburg, Massachusetts

☐ Please send me important articles which describe 5 methods of brush disposal, and 10 new ways to utilize brush chips.

☐ Please send more information on Fitchburg Chippers.

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CAN YOU RIP THAT ROCK?
Seismic Analysis Will Tell

ROCK hidden under a deceptive mantle of easy-loading dirt has given many a contractor nightmares. Other contractors have watched profits fade away in the clatter of blasting and shovels, only to learn as the work progressed the material could have been handled with ease at one-third the cost by rippers and scrapers.

Not many years ago blasting and shovels was the only practical way to move hard or rocky materials. Development of powerful crawler tractors during recent years has changed this picture, paving the way for application of rippers for shattering and loosening tough materials to speed scraper loading. As contractors gained experience with this new tool, they tackled harder materials, trying as they went to see if it would work.

Contractors learned that any material could be ripped, if conditions were right. The key to rippability seemed to be consolidation of the material. With no economical way to determine this factor, all they could do was try. But not many contractors could afford to invest in a $55,000 machine on the chance that it might work.

Caterpillar Tractor Co. engineers tackled this problem, looking for a fast, inexpensive and accurate way to determine if the material could be ripped before a tractor and ripper was moved in. Now, backed by more than 500 tests throughout the country, Caterpillar has developed the seismic analysis method to determine rippability.

Seismic analysis offers the desired features. It is simple in theory—sound waves travel through materials of different consolidations at different, predictable velocities. The velocity of the sound or shock wave through the subsurface material provides the answer to "can it be ripped?"

The equipment is lightweight, simple to operate and accurate. It includes a source of the sound or shock wave (an 8-pound sledge will do) and a receiver (a standard geophone) and an electronic counter. It all weighs about 40 pounds, and can be carried easily.

Contractor's personnel can learn to operate this equipment in less than an hour, following directions furnished by the manufacturer, Geophysical Specialties Company, Hopkins, Minn. (The seismograph, including self-contained batteries, costs less than $3,000.) Working with the equipment for a day or two under known conditions will quickly develop reliable accuracy of operation.

Operating procedure is simple. The electronic counter, housed in a small metal container about the size of an overnight case, operates on self-contained batteries. A geophone plugs into one receptacle on the counter's face. A long wire goes into another receptacle and the other end of the wire connects to a spring contact switch on the sledge. A small steel plate, when hit by the sledge, will produce a sufficiently strong wave for readings to 50 feet deep under most soil conditions. Blasting caps wrapped in a couple feet of primacord may be used if stronger waves are needed.

When the sledge strikes the plate, shock waves are sent through the ground and the switch closes, starting the counter. When the first wave reaches the counter through the geophone, it stops the counter. Time is recorded in milliseconds by flashing lights. The first check is made at 5 or 10 feet from the geophone, and successive checks in a line from the geophone in 5 or 10-foot steps, depending on soil and job conditions.

A complete test on a cut can be run in less than 30 minutes. Velocity (V) of the wave is found by the formula,

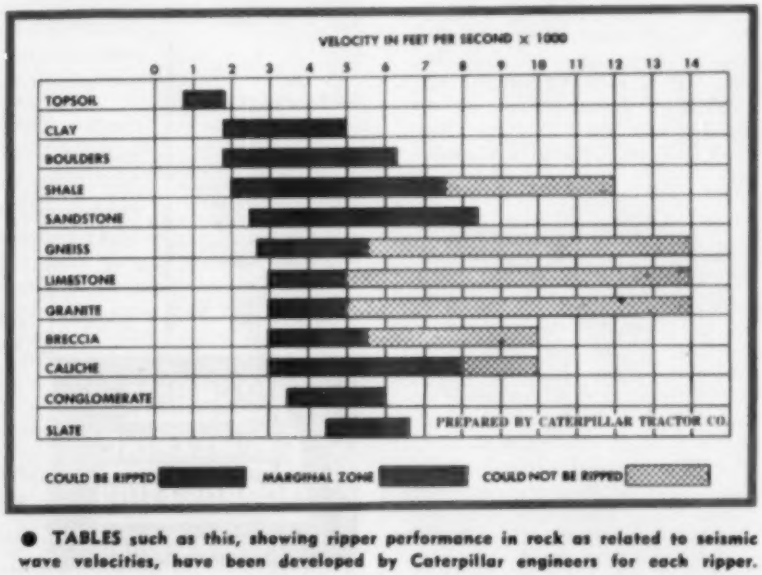
$$V = D/T$$

where D is the distance from the plate to the geophone and T is the time lapse. This is plotted on a graph, with distance in feet along the bottom and time in milliseconds up the side. Points fall in line for each type of material since velocities are the same for similar consolidations. Intersection of straight lines through adjacent points indicates changes in consolidation.

Depth at which these changes occur is computed by the formula,

$$D = \frac{X}{2}\sqrt{\frac{V_2 - V_1}{V_2 + V_1}}$$

where D is depth, X is the distance along the bottom of the graph from zero to the intersection point of the lines, V_1 is the velocity of the seismic wave in the upper layer and V_2 is the velocity in the next lower layer. Depths of successive layers are determined in similar fashion.



● **TABLES such as this, showing ripper performance in rock as related to seismic wave velocities, have been developed by Caterpillar engineers for each ripper.**

Accuracy has been established by running tests under known conditions and by checking ripper performance after tests. Caterpillar Tractor Co. and many of its Dealers have this equipment and conduct tests for contractors after the contracts have been awarded. More than 50 contractors own this equipment, using it to determine subsurface conditions before bidding and equipment scheduling.

On one highway project in Michigan's upper peninsula and another in the hills of southeastern Kentucky, contractors were planning to drill and blast. Seismic analysis showed large quantities of the rock could be ripped and handled by scrapers, at considerable reduction in cost per yard. Both contractors moved in two Cat D9 Tractors with mounted rippers, based on these findings.

The large number of tests have been amassed into a set of tables. Rippable and non-rippable velocities have been determined for each type of soil. In almost every case, a zone of marginal material divides these two categories. Rippability within this zone depends on soil conditions, machine condition and skill of the operator. Consequently each contractor must determine rippability within this zone. Many times he can almost completely eliminate it through experience.

Satisfactory results cannot be obtained when the surface is frozen. This ground is so consolidated that the surface wave almost always reaches the counter ahead of the subsurface wave, regardless of the density of these lower layers. Likewise, seismic analysis will not reveal the presence of softer materials below harder layers, such as in cap rock areas.

Several contractors have found completely unrelated uses for their equipment. One knew he had sandy clay as deep as he could go, but wondered how deep the water table was. Seismic velocities jumped when they hit waterbearing strata, pinpointing the water table.

Ripping is not considered a cure-all to every rock-handling problem. A contractor must weigh many considerations in deciding what method to use for a particular case. Factors are the type of equipment already on the job, availability of special tools, proximity of structures and populated areas, acceptable production rates, local regulations, relative costs per yard and insurance rates. But seismic analysis is showing the way to lower costs through ripping on many jobs.

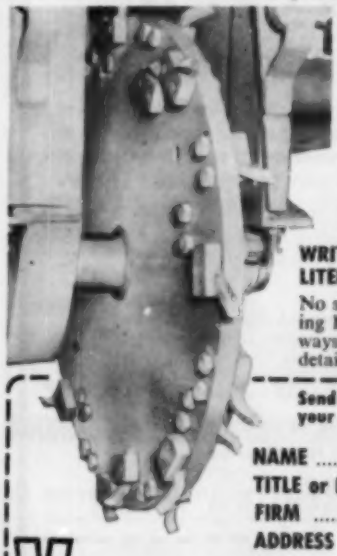
RIPS WIDEST STUMPS TO SHREDS . . . IN MINUTES!

FIRST IN THE FIELD

THE ORIGINAL, VERMEER

POW-R-STUMP CUTTER

You'll never know how easy stump removal can be, unless you've seen the Pow-R Stump Cutter in action. Here's the machine that has simplified this expensive, back-breaking, laborious job in cities, parks, golf courses and cemeteries all over the country. A one-man operation . . . a real time saver . . . a real labor saver! The Pow-R Stump Cutter removes the largest tree stump — rips it to shreds down to a depth of 10" below the ground — all in a matter of minutes. "Removed 44 stumps in 8 hours with the Pow-R-Stump Cutter" . . . is the report from one city recently.



The Leader . . . 10 To 1 Choice Of Tree Experts Everywhere

The Vermeer Pow-R Stump Cutter was FIRST . . . the original stump remover. It's a quality machine, ruggedly built to take on the toughest, largest stumps. Cuts wider stumps (a full 72") and higher stumps (37" above the ground) at one setting! Operator has full view of cutting wheel at all times . . . behind wire mesh safety shield.

WRITE FOR COMPLETE ILLUSTRATED LITERATURE AND LOW PRICES NOW

No stump to be hauled away. No gaping holes to fill. No damage to driveways, curbs or sidewalks. Get all the details by mailing the coupon below.

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New 1960
CUSHMAN
780 TRUCKSTER
with built-in economy

Cushman 780 Trucksters carry the biggest set of rugged muscles ever built into a light hauling vehicle. They offer the greatest economy . . . small initial investment, minimum maintenance expense, operating cost of less than a penny per mile, and savings on taxes and insurance.

Capable of carrying an 800 pound payload, the 780 Truckster is a versatile workhorse. It goes everywhere, parks anywhere, maneuvers easily in crowded quarters.

- New formed channel, automotive style chassis
- Bigger, stronger pick-up box
- Dependable Cushman Husky 4-cycle engine
- Constant mesh transmission
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Ask your dealer for a demonstration of how the Truckster can cut costs—or write for information

CUSHMAN MOTORS 947 No. 21st, Lincoln, Nebraska

A subsidiary of Outboard Marine Corporation, maker of Johnson and Evinrude outboard motors

Please send information on 780 Truckster.

NAME _____

(ATTACH TO YOUR LETTERHEAD)

Radiological Health Seminar

The School of Public Health of the University of North Carolina will conduct its 6th Radiological Health Seminar at Chapel Hill, North Carolina, on January 25, 26, and 27. Instruction by lecture, laboratory and seminar sessions will extend from the basic phenomena of radioactivity to health department responsibilities for its control.

Among the speakers will be: Dr. Elda Anderson and Roy J. Morton of the Oak Ridge National Laboratory; Dr. Donald R. Chadwick, Executive Secretary of the Federal Radiation Council; Newton I. Sax of the New York State Health Department; and Doctors Norm Tellis, A. D. Wolff, and Henry Rechen of the U. S. Public Health Service. Details from Professor Emil T. Chanlett, Department of Sanitary Engineering.

Consulting Engineers Council

The meeting of the Board of Directors of the Consulting Engineers Council was held in Cincinnati, O., Nov. 5 to 8. A principal speaker was Gail Hathaway, well-known engineer, now Consultant to the World Bank. A number of committee reports were presented and a public relations program is under way. This will include brochures and articles on selection of consulting engineers; fees; and private vs public engineering by Federal agencies. Larry Spiller, Reisch Bldg., Springfield, Ill., is Executive Secretary of the council which now has a membership of about 1000.

NEWS OF ENGINEERS

HAZEN & SAWYER, Consulting Engineers, are now in their new office at 360 Lexington Ave., New York 17, N. Y.

ROBERT C. MEISSNER has been elected president of Meissner Engineers, Inc., consultants, of Chicago, Ill.

W. VICTOR WEIR, president of the St. Louis Co. Water Co. and five other utilities was shot and killed in his office on Nov. 19. The killing resulted from the Company's foreclosure on some property.

VANCE, NEEDLES, BERGENDORF & SMITH, Ltd., has been formed to provide engineering and administrative services on design, operation and maintenance of expressways, airports and other facilities. Headquarters are at Woodstock, Ontario

EDWARD P. DECHER has been elected Executive Director of the Joint Meeting Sewer Commission of eleven municipalities in Essex and Union Counties, N. J. His offices are in the Newark City Hall. Also, he has been reelected Vice-President of the Essex County Mosquito Extermination Commission.

WILLIAM COLLINS, President of Walter Kidde Constructors, Inc., N.Y., has been elected President of the National Municipal League in which organization he has been active for many years.

MORRELL VROOMAN, Sr., nationally known Hydraulic and Sanitary Engineer of Gloversville, N. Y., died Nov. 7. In addition to his engineering and construction activities, he was prominent in many civic affairs. He was City Engineer of Gloversville from 1901 to 1913.

JOHN G. BUTTER has resigned as Chief Engineer of the Iowa State Highway Commission after 40 years of service. L. M. CLAUSON, Deputy, has been appointed Chief Engineer and R. M. TUTTON, a District Engineer, has been made Deputy Chief Engineer.

J. DAVID WELCH and MARTIN MALINOFSKY have formed a partnership for the practice of consulting engineering and geology. Offices will be at 382 Springfield Ave., Summit, N. J. Both were formerly with Howard, Needles, Tammen & Bergendorf. They will specialize in soils, foundations materials and aerial and air photo consultation and analysis.

DR. EUGENE WEISBERG has been made Director of Sanitary Engineering for Panlich Engineers, with offices at 1626 Forbes St., Pittsburgh 22. Formerly he was with the Graduate School of Public Health, University of Pittsburgh.

PAUL NORTHROP, Multnomah County Engineer, has been elected president of the Oregon Association of County Engineers. A. D. GRAHAM, Marion County Surveyor, is vice president and JOHN A. ANDERSON, Marion County Engineer, is Secretary-Treasurer. Of the 36 counties in the state, 34 are now registered members.

J. F. BAILEY is now Executive Vice President of Texas Vitrified Pipe Co. and Southwestern Plastic Pipe Co. He formerly was general manager and secretary. EDWARD F. CLEMENS is president. D. E. CLEMENS becomes secretary and general manager of Texas Vitrified Pipe Co.

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Model 560 - 3 1/2 to 5 1/2 Ton Roller

There's a

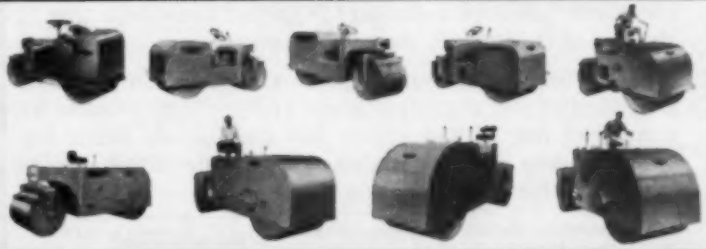
BIG DIFFERENCE

over a million miles of proof!

Essick Rollers, engineered and designed to offer a completely integrated line of 14 models, from 1/2 ton to 14 tons, are saving contractors thousands of dollars by providing more compaction at less cost—for any size job.

Contractors that use them....recommend them!

See for yourself—ask for a demonstration



14 models of Tandem Rollers – from ½ ton to 14 tons

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Affiliated with THE T. L. SMITH CO., Milwaukee, Wisconsin

Water Filtration Concepts

(*Continued from page 90*)

do so for all of us. This is, of course, none other than the A.W.W.A., and I do not believe that anyone in the water works field in any phase, would fail to realize that we would not be where we are today without their guidance and regulatory powers. However, the A.W.W.A. cannot carry the whole load by itself. I think it would be a very good idea for them, with our support, to outline a plan of procedure for public education, but we cannot expect them to contact our local papers, radio stations and TV to ask for support of, or if necessary, to pay for such a plan.

I have termed the foregoing discussion the primary or basic approach to our general problem which is, indeed, true because without adequate funds, needed developments and additional facilities for water treatment are delayed year after year by public apathy or public antagonism to increased tax expenditures. There is, however, another phase which is directly tied to water works progress. The following sentiments may tramp on a lot of toes and are bound to cause a definite amount of adverse criticism.

Rate Limitations

For what it may be worth, it is the writer's opinion that the more rapid advancement which should have taken place in the waterworks field in order to keep in step with the times has been hampered to a great degree by out-dated dogmas and codes at all levels. In numerous cases at both design and plant supervisory levels someone has had sufficient self confidence and initiative to step "outside the bounds" with the result that we have occasional outstanding advances in plant design, treatment, and operation. However, in general, plant capacities are still limited to a major degree by preordained regulations laid down in the days when a filter was the sole device of purification both from the standpoint of turbidity and bacterial removal. Nevertheless our codes and standards remain much as they were to the extent that the plant that operates over 2 gpm per sq. ft. is frowned upon and the operators thereof must assume the responsibility for water quality produced at higher rates.

As stated previously there are certain outstanding personages in the filter field who have by means of their experience and prestige stepped ahead, and by means of thorough experimentation proven that higher rates with resultant increase in plant output can still produce a quality of water compatible with established sanitary regulations. John Baylis of Chicago has been one of the foremost in this field and while, as is the case with any advanced achievement, not everyone agrees with every phase of his work, no one can mitigate the services he has rendered the filter field in general.

Anyone as well known in filtration work as Mr. Baylis and who has had facilities at his command for thorough experimentation and determination of end results cannot be taken lightly when he makes statements regarding certain findings. Consequently there has been a slow change in the trend of thinking. If it has served no other purpose, his work has done much to influence many others to conduct similar experimentation on their own. We now have a good many plants operating at consistently higher rates within the limitations of their original design. Certain changes have been made in existing plants through alterations in pretreatment where possible, utilizing

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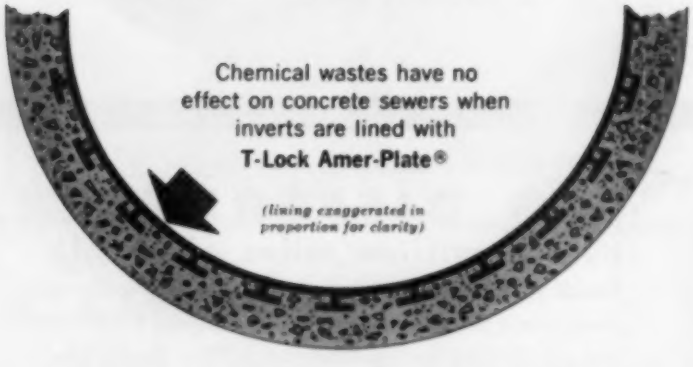

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better coagulants and other supplementary aids to offset inherent differences in raw water supplies. Different sizes and types of filter media are being used to make possible higher rates, and changes in back wash procedures and supplementary surface wash have again increased rate of flow and length of run while effecting savings in wash water.

All of these changes, made mostly on the initiative of individual plant supervision, have saved the taxpayer many millions in plant expansion. Does the taxpayer know this? Do the operating personnel get any credit for this? In 99 out of a hundred cases, no!

The consulting or designing engineer who gradually incorporates these changes into revamping older plants, or new installations, likewise gets no public acclaim for his efforts because the public does not know about them.

No doubt the main problem we are faced with is the general hesitancy on the part of regulatory agencies, both directly within our own field and on the municipal, state and national level, toward tampering with our codes governing plant operation and quality of plant output. It is pretty generally known that 3 to 4-gallon rates are entirely possible under proper supervision and control, and that the quality of water produced is as good or in many cases better than obtained at 2-gallon rates under former plant conditions. Changing the standards to allow this in general practice, however, is pretty much like speed limits. If the maximum is 25 the average is 30 mph. If you make it 30 though, we drive 35-40. Likewise the thought is that if production standards are raised to a 4-gallon level limit, there will be emergencies, so-called, or real, where 5 to 6-gallon rates will be used.

Can we continue, on the other hand, to spend $200,000 per plant output unit where $100,000 would do the job just as well? We have reached a point in national population where the yearly increase percentage will in a relatively short period of years make all of our present water production facilities inadequate. This is not only a local problem here and there. It is now, and will increasingly be, a national problem to the point of a catastrophe if we do not get our heads together and start working toward a common end.

At one time water was the most plentiful and the cheapest commodity in our economy. Today it is be-

(*Please turn to page* 168)

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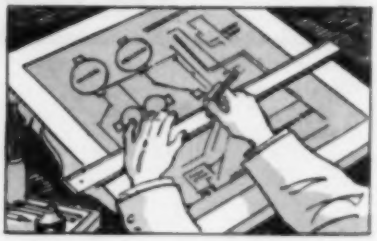

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coming an item of scarcity in many sections of our country, and of more and more vital importance to development of given areas. In these areas it is no longer a commodity, it is an economic necessity to be treated with the utmost respect as to availability, quantity and cost.

As this article is written, there is in the offing, a new development, with which the author is familiar, which if accepted generally will revolutionize the present theory of filtration. Even the ideas of our present "advanced" operators and designers will seem rather backward by comparison. Here again we must look ahead to increasing population and all of us must be acceptable to new theories or else this new idea will lay stagnant for years before it is accepted as a reasonable practice.

As initially stated, the author has not endeavored to present any theories or ready-made formulas for the prompt advancement of water works treatment. If it has been possible to awake an idea of possible cooperative effort in this field, the effort of you, the reader, and the writer will have been realized.

Water is our business, and everyone's life, so let us get down to "brass tacks" and work on it.

• • •

Trickling Filter Research

(*Continued from page 89*)

of the relative removal occurred at about the 2-foot depth in winter and in summer while a 75 percent removal at the 4-foot depth in summer and at the 5-foot depth in winter.

An important factor in filter design is the actual pounds of BOD removed per 1000 cubic feet of filter volume. Fig. 4 illustrates the relationship between dosing rates and the pounds of BOD removed by the pilot plant trickling filter, according to filter depth and season.

Summary

The following points summarized are applicable to high rate trickling filters being dosed with treated sewage having a 5-day BOD of 100 ±20 mg/L of oxygen in the range of 10 to 30 MGAD.

1) The percent reduction of BOD was the same at all the hydraulic loading rates at a specific depth.

2) The BOD reduction in summer is greater than that in winter.

3) There was no change in the relative percent of BOD removal at depths greater than 2 feet during summer.

4) The following occurred at the

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15 and 25 MGAD loading rates: Winter—50 percent of the relative BOD removal took place in the first 2 feet; 75% the first 4 feet. Summer—50 percent of the relative BOD removal occurred in the first foot; 75% in the first 2½ feet.

5) The importance of surface area to filter depth in removing BOD applied in pounds per 1000 cu. ft. of filter volume is governed by the hydraulic loading.

6) Of the environmental factors affecting filter efficiency, temperature is a major consideration where filter depth does not exceed 6 feet.

7) The highest BOD removal per 1000 cu. ft. of filter media occurred at the 3-foot depth and with a hydraulic loading of 30 MGAD.

Bibliography

1. Babbitt, H. E., *Sewerage and Sewage Treatment*, 7th Edition, John Wiley and Sons, New York, 1953.
2. National Research Council, "Sewage Treatment at Military Installations," *Sew. Works J.* 18, 417 (1946).
3. Keefer, C. E., and Meisel, J., "Remodeled Trickling Filters Exceed Expectations at Baltimore," *Water and Sewage Works*, 99, 277 (1952).
4. Keefer, C. E., and Kratz, H., Jr., "Experiments with High Rate Trickling Filters at Baltimore," *Sew. Works J.*, 12, 477 (1940).
5. Popel, F., "Die Leistrung and Berechnung von Spultroofkorform," *Ges. Ingimeur* Special Number Series 2, No. 21, 1943.
6. Rumpf A., "High Rate Trickling Filters in Germany," *Sew. and Ind. Wastes*, 28, 31, 1956.
7. Rizbi, M., Amramy, A., Shuval, H., Efficiency of a Small High Rate Trickling Filter in Jerusalem. Israel", *Sew. and Ind. Wastes*, 28, 7, 1956.
8. *Standard Methods for the Examination of Water, Sewage, and Industrial Wastes*, 10th Edition. American Public Health Assn., New York, 1955.
9. *Standards for Sewage Works*, upper Mississippi River Board of Public Health Engineers and Great Lakes Board of Public Health Engineers, July, 1954.
10. Gillard H. W., "The Accelo-Filter," *Sew. Works J.*, 13, 5, 918 (1941).

• • •

Who Collects Refuse in Cities?

On the 1958-1959 questionnaire sent by PUBLIC WORKS Magazine to city engineers, city managers, directors of public works and street superintendents this question was asked on rubbish collection: Is rubbish collected by municipal forces or by other means? There were 1158 replies to this question.

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Submersible Pump

The Kenco multi-purpose submersible pump Model 109 is compact, with corrosion-resistant cast-bronze construction and a liquid level control switch built into its watertight top. Readily portable, weighing only 42 pounds, the pumping capacity is 3300 gallons per hour at a 10-foot discharge head. The motor cannot flood or burn out, having a built-in thermal overload protector with automatic reset switch. More from Kenco Pump, 1305 Oberlin Ave., Lorain, Ohio.

Circle No. 1-1 on the convenient reply card facing page 36.

Gas Meter

Two new light-weight, large capacity, single-joint aluminum gas meters—the "3000" and the "10,000"—have been introduced by Rockwell, giving this company a complete line of aluminum meters, with capacities ranging from 150 cfh to 10,000 cfh. The new "3000" is rated at 3000 cfh and 1400 cfh at the 2-inch and ½-inch water column differential respectively, and the "10,000" is rated at 10,000 cfh at the 2-inch and at 4700 cfh at the ½-inch differential. The "10,000" has a working pressure of 100 psi, yet weighs only 310 lbs.; the "3000" also has a 100 psi working pressure and weighs but 100 lbs. For more information write Rockwell Mfg. Co., 400 No. Lexington Ave., Pittsburgh 8, Pa.

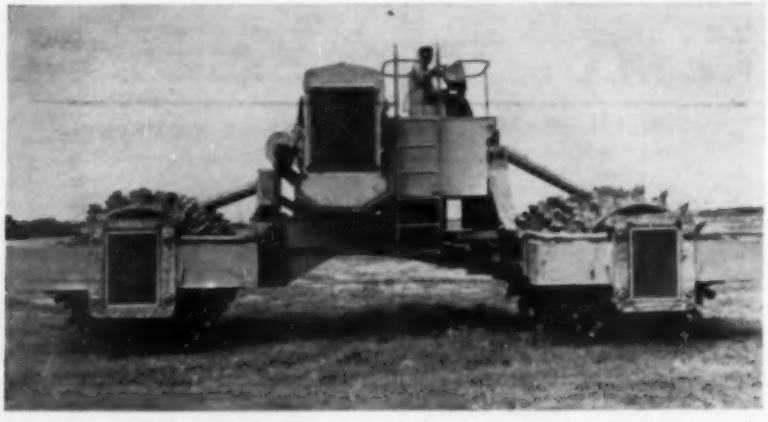
Circle No. 1-3 on the convenient reply card facing page 36.

Different Sheepsfoot Roller

These new so-called "sheepsfoot rollers" are self-propelled. An operator atop the unit fingers a panel of electric controls to drive the heavy rollers backward and forward at the rate of about 300 ft. per minute. Because they are electrically powered, they can travel both directions with identical speed and power. Any number of trips can thus be made over the same area without having to turn the machine around. In rounded figures, these rollers are 28 ft. long, 14 ft. wide, 12 ft. tall, and weigh 40 tons. Each has four independently oscillating drums, 5 ft. long and 5 ft. diameter, driven by dc motors geared in the inside rim of each drum. Power comes from two generators, driven by a 420-hp. GM diesel engine. Travel speed ranges up to 5 mph. The 480 replaceable "tamping feet" are nine inches long, and the flat circular head of each measures 10 sq. in.

More from R. G. LeTourneau, Inc., 2399 South MacArthur, Longview, Tex.

Circle No. 1-2 on the convenient reply card facing page 36.



Called "Power Packer," this diesel-electric sheepsfoot roller is operated by simply pushing buttons for controlling speeds to 5 mph in forward or backward directions.

Sludge Pump

The "Chicago" rotary position displacement sludge pump, known as "Scru-flo," is designed for the functions of primary sludge pumping, secondary sludge transfer, digester sludge recirculation, elutriated and concentrated sludge pumping, and digester heat exchanger pumping. Scru-flo pumps are positive displacement pumps, assuring maintained pumping capacity under conditions of varying solids concentration, offering varying friction factors and multiple piping layouts, to unblock clogged sludge lines and to operate with suction lift. A rag guard is provided and maintenance costs are reduced due to slow speed operation, and the use of Buna-N rubber stator and a hardened chrome-steel rotor. The Scru-flo is available with a belt and enclosed vari-drive for easy adjustment of pump capacity and is made in sizes from 75 to 375 gpm at 100-ft. head.

For details, write the Chicago Pump Co., 622 Diversey Parkway, Chicago 14, Ill.

Circle No. 1-4 on the convenient reply card facing page 36.

High Bonding Epoxies

Six new types of Epoxy resins for use in building, construction and maintenance have been announced by Sika. These epoxy compounds include joint sealants; crack sealants; bonding and patching compounds; skid-resistant surfacings for highways; and corrosion resistant surfacings for concrete. The materials exhibit high bond to structural materials, stability over a wide range of temperature, resistance to corrosion, compatibility to all concrete and masonry and rapid curing. When cured the materials will withstand temperatures up to 225°F, without impairing their physical properties. The epoxies are resistant to gasoline, oil, organic solvents, alkalies and most acids.

More information from Sika Chemical Corporation, 35 Gregory Ave., Passaic, N.J.

Circle No. 1-5 on the convenient reply card facing page 36.

Mobile Diaphragm Pump

For muddy water on construction jobs.

Four new diaphragm pump models have been announced by the Hale Fire Pump Co. These are 1½-in., 2-in., 3-in. and 4-in. The Hale diaphragm pumps are designed especially for the handling of high-solid-content water and for positive control of seepage. Compactly built and mounted on wheels, they handle easily in cramped quarters and are fast to set up and operate. They are available with gasoline engine or electric motor drive; the simplified design allows fast easy repairs if and when called for.

More from Hale Fire Pump Co., Conshohocken, Pa.

Circle No. 1-6 on the convenient reply card facing page 36.

All-hydraulic TS-360 motor scraper has turbocharged engine, high torque output.

Hydraulic Motor Scraper

Allis-Chalmers has a new all-hydraulic motor scraper with a 30-yd. heaped capacity and a 22.3-yd. struck capacity. This 63,150-lb. unit is powered by an Allis-Chalmers turbocharged engine developing 340 hp at 2,000 rpm. The scraper is mounted on 29.5 x 35 tires, and has the weight distribution necessary for maximum tractive effort, flotation and long tire life. Two-thirds of the total empty weight is carried on the drive wheels and one-third on the scraper wheels. When loaded, the total gross weight is equally distributed over all four wheels. More data from Allis-Chalmers Mfg. Co., Tractor Group, Milwaukee, Wisc.

Circle No. 1-7 on the convenient reply card facing page 36.

Street Cleaner

A vapor spray system that moistens all dust, dirt and debris as they are removed from the street by a powerful vacuum system is patented by and exclusive to the Baughman street cleaner. By means of controlled moisture introduced into the blower, street dirt loses its powdery consistency immediately and when carried by the ductwork into the truck body it stays there. The extra-large capacity body permits more hours on the job and fewer trips to the dump. A single-ram hoist elevates the body to a 45° angle at time of discharge for a faster, cleaner operation. When the body is raised, the body duct separates from the blower unit and makes cleaning quick and simple. The vacuum system is driven by a 70 hp air-cooled auxiliary engine. The resulting vacuum has plenty of pull to clean a full 8-foot strip. Handy cab controls operate the vacuum unit.

More data and illustrated literature from the Baughman Mfg. Co., Jerseyville, Ill.

Circle No. 1-8 on the convenient reply card facing page 36.

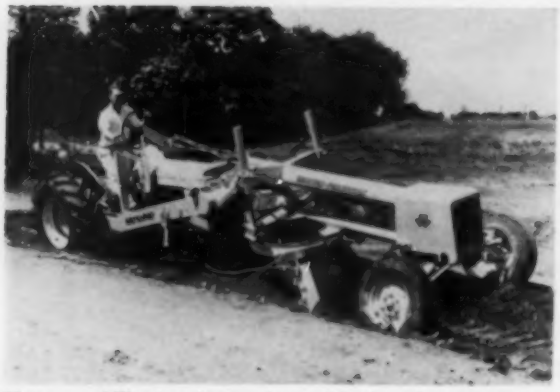
Detachable Loader

This all-new, heavy-duty type, loader is for Farmall and John Deere tractors. Known as Model M-620, the new loader fits 10 Farmall Models, H through 560, and 12 models of John Deere, A through 730. Ease of attaching to tractor and removing are features. The 9-cu. ft. bucket (combined with gravel plate) is 40 ins. wide and has bolted-in 1⅛-in. axle steel teeth. More data from Freeman Loader Corp., Blair Pike Rd., Peru, Ind.

Circle No. 1-9 on the convenient reply card facing page 36.

Loader for Farmall and Deere tractors.

Tractor Grader



Maneuverability is a feature in combined grader and tractor.

The Lev-L-All attachment turns the Massey-Ferguson 202 Industrial Tractor into a low-cost grader, maintainer, leveler and grader. Standard equipment includes hydraulically-operated leaning front wheels and lateral shift. Maneuverability is supplied by the long wheelbase and short turning radius —and the 145° of turn on the circle allows close positioning for "pulling a ditch." Turning radius of the 21-ft. unit is only 28 feet. The Lev-L-All provides good front-end stability and planing ability and is easily installed or detached to permit the tractor to be used for other work. More data from Massey-Ferguson Industrial Div., Block 1000 South West St., Wichita, Kans.

Circle No. 1-10 on the convenient reply card facing page 36.

Fork Truck

Good for carrying heavy loads outdoors over rough terrain.

A new indoor/outdoor, 6000-lb. capacity fork truck, the "Pacer," has been announced by American Road Equipment Company. It is available with either 10-foot standard lifting mast or optional 7-foot mast. The unit is front wheel driven and engineered so that the greater the load, the greater the traction under all conditions. The tires are 14:00 x 24:00. The short wheel base and oscillating rear steering axle permit high maneuverability. All units have power steering and torque converter. Engine is 73 brake horsepower F-226 Continental. Top speed is 30 miles per hour. Lift is a supercharged hydraulic type. Masts of either seven or ten feet are available.

More from American Road Equipment Co., 4201 No. 26th St., Omaha, Nebr.

Circle No. 1-13 on the convenient reply card facing page 36.

Vandal-Proof Grills for Parks

These low cost and rugged outdoor cooking units by Bennett-Ireland have been found to be vandal-proof, maintenance-free and highly satisfactory for all types of outdoor cooking. The Grilladier comes completely assembled with a simple pipe stand for permanent installation in concrete. It is all cast iron. The grill can be used for either wood or charcoal fire; two hinged grates open for easy fire control. The entire top rotates on the pipe stand to face the breeze, producing a forced draft and keeping smoke out of the chef's eyes. An under tray serves as an extra cooking and warming oven for covered foods, and prevents coals and ashes from falling to the ground.

Complete information from Bennett-Ireland, Inc., 47 Exchange St., Norwich, N. Y.

Circle No. 1-11 on the convenient reply card facing page 36.

Grader Tire

A new road grader tire, claimed to have improved traction and wear characteristics, has an all-Nylon cord body with extra-large tapered cleats that dig into the soil and prevent slippage, while the open center tread design promotes better cleaning. Called "Power Grader," the cleated type is available in sizes 9.00-24 through 18.00-26, with ply ratings from six to 14. Also, a smooth-tread tire is made in size 13.00-24 for use on freshly worked macadam roads. The smooth tread tire has the same cord body construction as the 10-ply lug type. More from B. F. Goodrich Tire Co., Akron, Ohio.

Circle No. 1-12 on the convenient reply card facing page 36.

For Locating Underground Non-Metallic Pipes

The "Scinta-Ray" is a new technique using a radioactive source and scintillation instrument for tracing non-metallic pipes, locating cesspools and septic tanks, and pinpointing pipe stoppages. The technique consists of attaching a radioactive source to a wire, cable, plumbers' snake or a sewer tape, and pushing it down the line. The operator, on the surface, follows the exact path of the source with "Scinta-Ray" readings. The instrument indicates any obstruction in a septic tank or cesspool.

More data from The Goldak Co., Inc., 1544 W. Glenoaks Blvd., Glendale 1, Calif.

Circle No. 1-14 on the convenient reply card facing page 36.

Self-Trailing Roller

Hydraulic operation of self-trailing wheels for maximum portability is a feature of the new model 650-C two-wheel Essick tandem roller. This unit weighs from 4½ to 6½ tons, the size roller most normally requiring portability. During rolling operations, the travel wheels are retracted upward to a high position. Where close wall clearances are necessary, the travel wheels can be quickly removed. Finger-tip manipulation by the operator of two individual valves control the power to

operate the trailing mechanism. One valve controls adjustment of the height of the towing hitch, while the other valve swings the wheels under the roller and raises the roll to towing position. The engine is 4-cylinder 32 hp Continental water cooled. The compression roll produces 228 lbs. per lineal inch compression with water ballast.

More from Essick Mfg. Co., 1950 Santa Fe Ave., Los Angeles 21, Calif.

Circle No. 1-15 on the convenient reply card facing page 36.

Small Incinerator

A new incinerator has been introduced by Morse-Boulger — the CT destructor. This destructor utilizes a heavy gauge outer shell and high heat duty firebrick, backed with a new overall type of insulation. As part of the new features, a dump-and-shaker lever has been added which provides for easy removal of ash without bending and shovelling. Also new is a swingaway charging door for ease of operation and for safety, keeping the hot face of the door away from the operator. The new CT destructor has been primarily designed for use in schools, universities, hospitals, apartments, stores, institutions, clubs, factories, hotels and warehouses.

More from Morse Boulger, Inc., 80 Fifth Ave., New York 11, N.Y.

Circle No. 1-16 on the convenient reply card facing page 36.

Radio Towers

A complete line of tubular alloy steel communications towers provide structures ranging from 10 to 500 feet in height. The towers are of three-sided sectional design. The sections are 10 or 20 feet long and in four weights. The heaviest towers can be raised to 500 feet with 30 pounds per square foot windloading, or up to 360 feet with 40 pounds per square foot windloading. Guys are specified for towers that are more than 100 feet high in the heaviest models, and for lesser heights in the lighter models. Sections are designed for easy assembly and are fastened by drive fit, high carbon steel bolts. All accessories, such as necessary lights, guys, clamps, anchors and assembly hardware, are shipped with each tower.

More details from Motorola, Inc., 4501 Augusta Blvd., Chicago 51, Ill.

Circle No. 1-17 on the convenient reply card facing page 36.

Pavement Ripper

A new hydraulically operated rear mounted ripper, designed to rip asphalt pavements to a 12-in. depth, has been announced by American Tractor. The ripper is exclusively for use on Model 660 and 550 Adams motor graders. The ripper, which can accommodate up to seven ripping shanks is mounted on the motor grader's rear frame where the weight and hydraulic power help in penetration and ripping in the toughest material. However the ripper does not replace the front mounted scarifier which is necessary for operating around obstructions, manholes, etc. A variety of attachments are available—straight or curved shanks, with either steel or sphereulite replaceable points, splitter and shank guards and a scoring disk for cutting asphalt pavements to limit the ripping area as required. The "Ateco" ripper is available only through LeTourneau-Westinghouse distributors.

Circle No. 1-18 on the convenient reply card facing page 36.

Ateco ripper for integral mounting on LeTourneau-Westinghouse graders.

Heavy Duty Crane

The new 17½-ton Little Giant crane-shovel-clam-dragline, Model 48, is an entirely new unit designed to meet current contractor need for an extra heavy duty machine in the top range of the small crane field. It is in production as a crawler, self propelled, or carrier mounted machine, and is available for barge or pedestal mounting. All front end attachments are available: clam-shell, dragline, crane, shovel, trenchoe, magnet, pile driver, or skull cracker. Crane attachments are box type lattice boom with single or double sheaves. Interchangeable main boom sections are designed to handle all types of loads from the standard 30-ft. boom length up to 85-ft. with 15-ft. jib.

More from Little Giant Crane & Shovel, Inc., Des Moines, Ia.

Circle No. 1-19 on the convenient reply card facing page 36.

Two-Way Tamping Roller

Shovel Supply Company announces their Model SP-22, self-propelled double-drum tamping roller. The drums are 5 ft. in diameter and 6 ft. long, with feet 9¼ ins. long. Power to each drum is supplied by a GM 125 hp diesel engine, Allison 3-speed transmission, torque converter and roller chain final drive running in oil. Speeds are to 8 miles per hour, forward and reverse. Feet with removable caps are furnished when desired. Empty weight is 51,400 lbs. With water ballast, any desired weight up to 5500 lbs. per foot of drum length may be obtained. The roller operates equally well in either direction. Full data from Shovel Supply Co., Inc., Box 1369, Dallas 21, Tex.

Tamper drums carry 5500 lbs. per foot.

Circle No. 1-20 on the convenient reply card facing page 36.

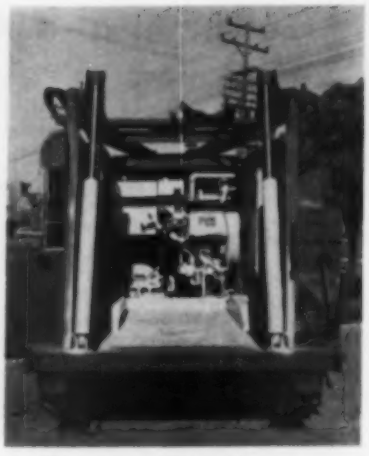
Single-Stick Control for Crawler Tractors

A new master control for crawler tractors has been developed by John Deere. This is a single-stick control which activates hydraulics to perform the various steps of clutching, braking, steering, and shifting for forward and reverse travel. The new control, called "Pilot-Touch," will be offered as optional equipment on John Deere "440" Industrial Crawlers. With the new control, the operator merely has to select his speed of travel, then move the control stick forward and return or backward and return for forward or backward motion as desired. To turn, the operator merely moves the stick to the right or to the left.

One hand is freed for other operations.

More details from John Deere Industrial Division, Moline, Ill., attention H. F. Linde.

Circle No. 1-21 on the convenient reply card facing page 36.



Power Package

A unit designed to power all the hydraulic equipment needed on a utility construction body has been made an integral part of the new Uni-Power Body now being manufactured by Holan. The "power package" consists of a 56-hp air-cooled engine, a Braden hydraulic winch and a tandem hydraulic pump with 50-gallon oil reservoir. This package powers the hydraulic derrick, winch, digger and supporting jacks. The power unit—located just behind the crew compartment in the bed of the body—can be lifted out as a unit or by component parts for repair or replacement without removing the body. All hydraulic piping is under the floor of the body and clear of the chassis. In addition to speedy body mounting or changeover, the Uni-Power Body offers many other advantages. Gasoline used in the stationary power plant is free of road tax. Engine idling is eliminated. Down time for maintenance is drastically reduced.

More on the Uni-Power Body from Holan Corp., 4100 West 150th St., Cleveland 35, Ohio.

Circle No. 1-22 on the convenient reply card facing page 36.

Submergible Pumps for 3-inch Wells

Two Reda submergible pumps have been announced for 3-inch wells. The "X-4" provides capacity to over 400 gallons per hour; the "X-7" to over 600 gallons per hour. Both units are ½ horsepower, 115-volt, single-phase models. Ask for Bulletin R-685, Reda Pump Co., Bartlesville, Okla.

Circle No. 1-23 on the convenient reply card facing page 36.

Portable Two-Way Radio

A light weight, portable two-way FM radio receiver has been added to the product line of the Mobile Radio Department of Allen B. Du Mont Laboratories, Inc. Designed for use by public safety officers, contractors, field engineers, survey crews, forestry men, and others with need for two-way communication while on foot. The Du Mont Portacom includes a handset, FM receiver, one or two channel FM transmitter, demountable whip antenna, battery pack, and carrying strap. Units are available with loudspeaker and palm microphone and for use on the 25-54 mc frequencies or 144-174 mc band. The unit weighs only 8 lbs.

More information from Allen B. Du Mont Laboratories, Inc., Clifton, N. J.

Circle No. 1-24 on the convenient reply card facing page 36.

Pneumatic Ejectors

Two pneumatic ejectors have been added to the Smith & Loveless line. The "Uniject" is for single dwellings and is designed for capacities to 15 GPM at 20-ft. TDH. This automatic lift station is intended for those few homes in a subdivision which may lay below the level for gravity sewer service—eliminating the necessity of lowering the entire sewer system. This prefabricated unit handles low sewage flows and large solids. The "Vac-O-Ject" handles flows from 30 to 100 GPM. It combines the principle of vacuum intake with air-pressure ejection. It is economical to install and can be used as a separate sewage lift station of small capacity.

More from Smith & Loveless, Inc., Lenexa, Kansas.

Circle No. 1-25 on the convenient reply card facing page 36.

Bituminous Tank Truck

A new double-tapered bituminous hauling tank is announced by Etnyre. An advantage claimed for the new design is that it provides positive center drainage with greater tank strength through the use of a conical cross-section shape. This double-tapered design gives Etnyre a range of four different hauling tank designs.

More from E. D. Etnyre and Company, Oregon, Ill.

Circle No. 1-26 on the convenient reply card facing page 36.

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—Worth Seeing

"Try this on for size" may have been Worthington's suggestion to the young lady shown standing in the 5 ft. 6 in. diameter discharge area of this 80-ton giant. The pump is one of two supplied for the Chicago Metropolitan Sanitary District system to join four others installed in 1937. In operation the pump will move 180,000 gallons per minute.

This picture is dated by its cobble stone pavement but the pipe is not! It is an old photograph showing one of the earliest installations of Johns-Manville Transite Pipe, which celebrated its 30th year or water service last November.

Mud and snow made working conditions so bad on Michigan road construction jobs last October that one contractor resorted to ox-power to clean out drainage ditches alongside a six-mile highway reconstruction project on M-46.

Giant job in New Jersey on Interstate Route I-78 included moving 3,600,000 cubic yards of earth in a 5-mile section. 15 International Model 95 Payhauler units and 14 International TD-24 crawlers were used to move a total of 20,000 cubic yards every 9 hours.

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The modern building combining Madison, Wisconsin's City Hall and Dane County Courthouse uses a 35 KW Kohler electric plant for emergency electricity when normal power fails. The Kohler plant insures uninterrupted use of radio systems by city police and county sheriff's office, maintains essential lighting in dispatcher's room, and electric lock and signal system, as well as lighting, for city and county jails.

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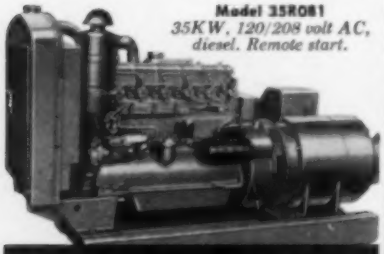

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35KW, 120/208 volt AC, diesel. Remote start.

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by Arthur K. Akers

★ Happy New Year and a prosperous one to all!

★ International Salt Co. now occupies its own "Salt Headquarters" building at Clarks Summit, Pa., just north of Scranton at junction of U. S. Route 11 and Pa. 207.

★ National Slag Association elected **Charles W. Ireland** of Vulcan Materials Co., Birmingham, president; **Edward C. Levy, Sr.,** Detroit, vice president; and **W. C. Shaw,** Washington, D.C., treasurer. **E. W. Bauman** was re-elected managing director.

★ **Marvin Lane** is promoted to general manager, Graver Water Conditioning Co., New York, succeeding **H. T. Sulcer,** resigned.

★ Traffic Signals, Inc., is the new name of Southern Signals Inc., Shreveport, La. Executive personnel is unchanged, the corporate name being changed to make clear that the company sells nationally.

★ **Arthur B. Horton** named board chairman, Chicago Bridge & Iron Co. **Dr. E. E. Michaels,** president, was elected chief executive officer.

★ **Wayne L. Dowdey** promoted from Southern and Pittsburgh Districts of the Eimco Corporation to general sales manager at Salt Lake City. **Paul O. Richter** becomes general manager of the Filter Division.

★ **Frank T. House** is new sales promotion manager, Bucyrus-Erie Co., South Milwaukee.

★ **E. Roy Russell** retired Nov. 30, 1959, as president of the Florence Pipe Foundry and Machinery Co. and of the R. D. Wood Co. **Warren A. Brown,** vice president of the Florence Co., succeeds him.

★ **Everett M. ("Casey") Jones** announces appointment of **Raymond E. Hicks,** as Eastern engineering manager, Water and Valve Sales Division, Rockwell Mfg. Co.

★ Westinghouse Electric Corp. will create a centralized research and development center in Pittsburgh, in new buildings on a 100-acre site.

Mr. Meloun

★ General Electric Co. appoints **Charles J. Meloun,** manager of marketing for their Outdoor Lighting Department, which is located at Hendersonville, North Carolina.

★ Smith & Loveless, Kansas City, said to be the world's largest manufacturer of factory-built sewage lift stations, becomes a division of Union Tank Car Co.

★ **John H. Brinker** is elected executive vice president, the J. I. Case Co., Racine, Wis. He was formerly vice president and general manager, A. O. Smith Corporation.

★ Keuffel & Esser, Hoboken, N. J., engineers and draftsman's equipment, establish a new subsidiary by the same name in Denver, Colo.

★ **James F. Foley,** named Farm Equipment Division advertising manager by Allis-Chalmers Mfg. Co., Milwaukee.

★ **Russell W. Wetjen** becomes vice president and general manager of Granberg Corporation, subsidiary of American Meter Co., but remains in same positions with another American subsidiary, the Buffalo Meter Co. at Buffalo.

★ Dorr-Oliver Inc., appoints **J. D. Hitch Jr.,** president, to its vacant board chairmanship, and elects **L. R. Boling** to succeed Mr. Hitch as president.

★ The Kansas City office of Ludlow Valve Mfg. Co., Troy, N. Y., will now be under supervision of **James La Porte,** succeeding **Thomas McGinley.**

★ B-I-F Industries, Providence, elects **Richard W. Pearce,** works manager, and **William L. Sammons,** general sales manager, to vice presidencies.

★ Visitor: "Where does this lane lead to?" Native: "Well, it's led half of the young folks around these parts into trouble."

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NEW!

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Body Coupling Nut for copper pipe.

Tailpiece with outside I.P. Thread.

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These new, time-saving couplings can be quickly installed in any existing piping without cutting threads or sweating joints. Simply cut a short section from the pipe, slip the compression couplings over the ends of the pipe, assemble the yoke to the couplings and tighten the compression coupling nuts.

Compression couplings can be furnished for steel pipe or copper pipe in both the regular compression nut design or the locking nut designs shown. The locking nut type positively prevents any movement of the yoke on the pipe and insures continuous electrical bonding of the service line.

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